ASSESSMENT OF POTENTIAL APPROACHES TO CHARCOAL AS A SUSTAINABLE SOURCE OF INCOME IN THE ARID AND SEMI-ARID LANDS OF KENYA

FINAL REPORT

A STUDY COMMISSIONED BY DANIDA AND RELMA
OCTOBER 2003
EXECUTIVE SUMMARY

Charcoal provides 82% of urban and 34% of rural domestic energy. This industry represents an estimated annual market value of Kshs. 23 billion with only a sixth of this value being channeled back to the producing rural communities. Of Kenya’s total land area of 57.6 million hectares 84% is arid and semi-arid (ASAL). With only 1.7% of the country being covered with closed forest, it is estimated that over 75% of the 2.4 million tons of charcoal used in the country is unsustainably harvested from the arid and semi-arid lands. As a result of the observed disastrous environmental degradation of forests, woodlands and rangelands in the ASALs, as well as the unsustainable national energy consumption, Danida’s ASP-MEDP-MFII and RELMA have found it necessary to address this problem by considering how sustainable charcoal production and marketing systems can become an integrated part of their project activities and hence contribute to improved livelihoods of the target communities.

Danida and RELMA commissioned a study to: a. identify and prepare a list of previous and present documentation on charcoal production in Kenya, b. carry out an assessment on the existing legislation and policies under relevant, Kenyan authorities regarding charcoal production and trade, c. identify potential stakeholders and their perceptions on charcoal production at the producer level and cooperation partners within the project areas and assess their capabilities and possible organizational structures, d. assess the type of kilns used in rural charcoal production systems and their possible environmental implications, e. assess existing marketing systems and price structures, and constraints facing the producers and traders, f. and prepare a report indicating the potential approaches and analyses of possible ways forward including cooperation with other stakeholders.

The methodology used in the assessment includes five components: Literature review, personal interviews with resource people in key institutions, field visits, round table meetings in the four case (Kitui, Makueni, Taita Taveta and Kwale) Districts, and a review workshop in which two successful models (Sudan and Kajiado) were also given.
All the information was analyzed qualitatively and reported descriptively with photographic impressions for clarity. The findings show that:

**Legislation and Policy:** All the policy makers interviewed expressed confusion as concerns charcoal. They are certain that it is a very important source of energy especially for the urban middle and low income households who form 80% of the urban population, but they were in a dilemma as to how charcoal can be supplied sustainably. There are no specific laws and policies for or against charcoal, however, with commitment and allocation of adequate resources, the bits and pieces in various related acts and policy documents can be used to plan for sustainable supply and utilization of charcoal. The successful model of Sudan where charcoal has been legalized and produced sustainably on 15 year cycle of *Acacia seyal* and *Acacia senegal* can serve as an example. There is still an urgent need to develop charcoal specific policies and laws for efficient management of the industry. Completion of the Renewable Energy Policy and Bill should therefore be given adequate and urgent attention. In addition, pilot activities should be implemented in appropriate sites.

**Production systems:** Three charcoal production systems were identified. They include charcoal from ranches (45%), small-scale farms (40%) and government land (15%). Charcoal is normally produced as a secondary product of land clearing for agriculture and livestock rearing, however, due to increasing poverty, unemployment and frequency of droughts, it is being produced as a primary product by a significant proportion of producers. Before, charcoal used to be produced seasonally but lately, it has become a commercial enterprise the whole year round. Experiments on a 712 hectare land of Muka Mukuu Cooperative Society in Machakos has shown that if the half-orange kiln is used for processing, charcoal is a very profitable enterprise. Similar results have been given for the Elangate Wuas Group Ranch in Kajiado and the National Forest Corporation in Sudan. Ranch and farm plans should be developed to incorporate charcoal production as a cash crop. Management plans should include natural regeneration, enrichment planting, selective harvesting, rotational harvesting and indigenous and exotic tree woodlots and plantations where possible.
**Institutional arrangements:** Seventeen institutions playing different roles were identified. The key ones, however, are the Ministries of Environment, Natural Resources and Wildlife, Energy, Agriculture, Livestock, Lands and Settlement, Local Government and Gender, Culture, Sports and Social Services; Office of the President (OP-Chiefs and Police). Several NGOs and CBOs were also identified. Forming of charcoal producer and marketing associations with technical support from integrated extension teams was identified as the way forward for institutional arrangements at the community level. The District Environmental Committee was identified as the institution to manage and coordinate charcoal issues and also collect levies and distribute among the stakeholders for investment in its sustainable production and marketing. It is suggested that 40% of the levy should be used for afforestation and re-forestation.

**Charcoal processing:** Four types of charcoal processing kilns of different efficiencies and cost were identified. They include the traditional earth kilns with 10-15%, improved earth kilns 24-30%, the masonry kilns with 28-30% and metal kilns with 19-30% efficiency. The metal kilns were reported to be portable and faster but their costs are high. The improved earth kilns were identified as the most appropriate for the short and medium term for individual farm processing. Community groups could also use the masonry kilns in centralized processing centres as well as private companies and ranches.

**Environmental effects:** Unsustainable harvesting of trees for charcoal is leading to increased soil erosion, water run-off and change in micro-climate. In addition, substantial air pollution is emitted from charcoal processing and utilization. The selective harvesting of the preferred tree species like *Acacia tortilis*, *Acacia nilotica*, *Balanites egyptiaca* and the combretums was leaving the *Commiphora africana* and *Commiphora baluensis* species, which are very light and less valuable for charcoal. This interferes with biodiversity and the ecological stability of the ASALs. Planned and balanced production and efficient processing technologies can significantly reduce these negative
environmental effects, however, there is no incentive for planned production without a proper policy in place.

Marketing: Four marketing schemes were identified. They include: a. a producer selling to a broker rather than directly to transporters, b. producers arranging for their own selling points, c. traders accessing producers directly at the production site and d. producers selling to their contractor. Scheme a. and b. were found to be common among the small scale farmers while scheme c. and d. were common in raches. Producer price ranged from Kshs. 70-150 while consumer prices ranged between Kshs. 350 in Mombasa to Kshs. 500 in Nairobi. The chain level price difference ranged from Kshs. 20 to 80. With the current marketing arrangements, the largescale transporter earns an unproportionately higher income than the producer. Formation of charcoal marketing associations can contribute towards fair distribution of revenue from the charcoal trade. In Sudan charcoal producers and traders have officially recognized associations, which help in coordinating production and trade through by-laws.

Conclusion and the way forward: The study concludes that since charcoal does not have ideal substitutes, its use and high demand will continue for the foreseeable future. In addition, from the employment point of view, it is more beneficial for Kenya to grow and manage trees for charcoal than importing LPG. Where wood supply is not a constraint, fulltime charcoal producers can earn between Kshs. 20,000 and 30,000 per month. The ASAL land is ideal for charcoal production because of land availability and limited livelihood opportunities for the rural communities. Considering the four case districts only, up to 85% of the land could be used for charcoal production. Given the regular occurrence of droughts in the ASALs, all the 6.9 million people can benefit from charcoal production. However, for the charcoal industry to flourish, there is need to create an enabling environment through legislation and awareness among top government officials on the great employment and income potential from having sustainable charcoal production in the ASALs. This shall be achieved through policy briefs for key stakeholders, policy dialogues with relevant development drivers particularly members of parliament (legislators) from the ASAL districts, government policy makers and senior
technical staff together with grass roots application of sustainable management principles. Sudan produces charcoal on land, which receives only 250 mm. of rainfall, there is therefore no reason for Kenya not to succeed.
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Nairobi, October 13, 2003

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Fridah W. Mugo                      Erik Poulstrup
1. Introduction
This report contains the outcome of a joint study commissioned by the integrated agricultural project of Danish International Development Agency (Danida)\textsuperscript{1} and Regional Land Management Unit (RELMA)\textsuperscript{2} to assess potential ways forward concerning the currently unsustainable charcoal production, whereby 2.4 million tonnes of charcoal\textsuperscript{3} is consumed annually generating a retail turnover of more than Kshs. 23 billion. Charcoal and money that is not accounted for, or registered, anywhere in official records.

1.1 Background
The down-rated charcoal industry attains its supply mainly from rural communities, yet the main consumption is in the urban and semi-urban centers. Charcoal is the most important energy source in urban households\textsuperscript{4}, where it is used for cooking food, heating homes and ironing clothes. In the urban industries e.g. hotels, charcoal is likewise important. Many stakeholders see the legislative framework as uncertain and confusing, and sadly enough only one sixth of the retail turnover is retrieved at producer level: This uncertainty hampers charcoal production and trade from becoming a legal enterprise that can be managed, regulated and optimized in a sustainable manner. The disastrous environmental impacts in the rural communities caused mainly by a continued degradation of the forest land, woodland and rangeland, as well as the unsustainable extraction of wood energy, has deemed it necessary to address this problem by considering how charcoal production and marketing systems can become more sustainable. There is also need to explore how assistance to this sector can become an integrated part of other development activities and hence contribute to the endeavors of improving livelihoods of the rural population in the ASALs of Kenya.

\textsuperscript{1} Namely the ASP, MEDP and MFII projects, see 1.2.
\textsuperscript{2} Regional Land Management unit is part of Swedish International Development Agency (Sida).
\textsuperscript{4} \textit{Ibid}
1.2 Danida and RELMA
The Project Coordination Unit (PCU) of the integrated Danida project includes three project elements, i.e. the Agricultural Support Project (ASP), the Micro Enterprise Development Project (MEDP) and the Micro Finance Institution Initiatives (MFII).

The declared objective of ASP-MEDP-MFII is to improve the livelihoods of the rural poor in the Arid and Semi Arid (ASAL) areas of Kenya. The integrated project presently covers 4 districts namely: Kitui, Kwale, Makueni and Taita Taveta. The total population in the four districts is approximately 2 million people (30 percent of the total ASAL population).

RELMA operates at regional level in six countries in Eastern and Southern Africa namely: Eritrea, Ethiopia, Kenya, Uganda, Tanzania and Zambia. RELMA has the declared mandate of contributing towards improving livelihoods and enhancing food security among small-scale land users in the region. Both organizations have identified charcoal production, especially in the ASALs, as a problem that must be dealt with. Sustainable management principles must be applied in order to sustain other community based development activities.

1.3 Charcoal in ASAL areas in Kenya
Of Kenya’s total land area 84% is classified as ASAL and 23% of the population inhabits this land. Due to lack of adequate rain and access to water for successful agricultural production, other income generating activities are explored, and the woody resource is one of the most accessible and easy to exploit. The current reality is that wood is a resource free of charge.

Going from Nairobi towards Mombasa, and passing through Mariakani market place provides a frightening, but realistic, example of the massive over-exploitation of woody resources. The height of the vegetative cover shows that something is missing: The trees. In addition to the degraded landscape, huge piles of charcoal bags are seen a waiting ferrying to Mombasa City.

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5 P. Konuche, Director of Kenya Forest Research Institute (KEFRI), personal comment.
Charcoal production used to be a seasonal activity. Lately, the production and trade has become an important source of income in rural ASAL especially in seasons when manual labor is abundant e.g. the period between end of harvesting and start of planting. The seasonal pattern has changed into an all year round charcoal production enterprise. The lack of alternative forms of livelihood has forced many charcoal burners to take up the enterprise on a subsistence basis. While many perceive charcoal production as a secondary activity from clearing of land for agriculture and livestock rearing, a significant proportion is carried out as a primary activity i.e. cut trees for the main reason of producing charcoal as a subsistence activity. Some charcoal is also produced from wood poached from either government forests or national parks either as a secondary or subsistence activity. It is however difficult to estimate the proportion of charcoal from these two sources.

A frightening scenario has been reported from Mutito Division, Kitui District, where charcoal burners burn the *Acacia tortilis* (Umbrella thorn) even in the month of August, when the pastoralists depend on the acacia pods as their main source of forage for their livestock.

### 1.3 The current problems

There are many problems associated with the current black market position of charcoal. The main problem is the lack of guidance from a legislative framework. The former president issued a presidential ban in 1986 and by this ban the government has lost its control of the industry. “How can a trade that has been officially outlawed be regulated?”

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6 Subsistence in this report is used to explain the case were charcoal producers are producing charcoal as the only way of sustaining livelihood, where agricultural activities (if any) are of secondary importance.

7 Dr. Konouche, Director of KEFRI.

8 DLPO Kitui District Mr. Ngori and DFO Kitui District Mr. A. M. Gondo.

9 The ban was in fact the second ban. The first ban (on export of charcoal) was issued nine years earlier in 1977 by President Jomo Kenyatta after being taken to a forest and experiencing how the forest was being transformed into a myriad of kilns.

The huge demand of the commodity cannot be swept away. On the contrary, the business is very lucrative because of the high demand and availability of a distribution network. Another problem, which is a derivative of the first, is that the environmental impact of over-exploitation of the fragile vegetation in the ASALs will lead to physical degradation of the soil and a completely changed water regime due to extensive evaporation and less ground water recharge. A third problem is likewise a derivative of the first. From the production side, there is a number of shortcomings. The production input (the fresh wood) is not priced since there is no evident intrinsic value. Labor is also a non-priced input and the result is that the cost-price at producer level (farm gate level) is artificially low. This brings about a distortion of the market for renewable energy, where alternative energy sources face unfair competition.

1.5 Objectives
The overall objective of the study was to identify potential approaches to transform the current charcoal production systems into a sustainable utilization of a rural resource and a source of income in the rural communities. The geographical focus was predominantly laid on ASALs of Kenya, and the four case districts served as the basis for mapping out the situation at the ground level. The terms of reference for this study were:

i. Identify and prepare a list of previous and present documentation on charcoal production in Kenya.

ii. Carry out an assessment on the existing legislation and policies under relevant, Kenyan authorities regarding charcoal production and trade.

iii. Identify potential stakeholders and their perceptions on charcoal production at the producer level and cooperation partners within the project areas, and assess their capabilities and possible organizational structures.

iv. Assess the type of kilns used in rural charcoal production systems and their possible environmental implications.
v. Assess existing marketing systems and price structures, and constraints facing the producers and traders.

vi. Prepare a report indicating the potential approaches and analyses of possible ways forward including cooperation with other stakeholders.

1.6 Report Intention and limitation
This report provides an assessment of stakeholders’ perceptions and anticipations from producer level to policy level. An effort has been made to disclose the constraints to sustainable charcoal production and marketing in Kenya with an attempt to balance socio-economic and ecological considerations. It is not within the scope of this report to present project development activities that are implementable in the field. For any development activity to be implemented, area specific solid project appraisals have to be carried out; to which this document can serve as a basis for, but not compromise, before such attempts can be considered.

1.7 Outline of report
Chapter one has given the background to the study. Chapter two presents the methodology used in this assessment. Chapter three outlines the legislative framework of charcoal in Kenya; in this part both relevant laws and policies have been presented. Following, in chapter four is an outline of the institutional arrangements and organizations involved in the charcoal industry. In chapter five the different production systems and their relative importance are presented. An overview of the different charcoal processing technologies and potential improvements is found. In chapter seven the marketing systems and price structures are presented. Chapter eight discusses the study findings and presents recommendations, while the conclusion is given in chapter nine. A bibliography has been appended to this report for additional reading and the convenience of decision making in future.
2. Methodology

The methodology used in the assessment includes five components that are presented below. Two weeks were spent interviewing key stakeholders and institutions. Another two weeks were spent in the field, where four districts were visited. They include Kitui, Makueni, Taita Taveta and Kwale Districts. All information was qualitatively analyzed, with a special attention to comparing central level information (e.g. policy makers’ viewpoints) with the information obtained from the field visits (e.g. producers and traders viewpoints).

2.1 Literature review

Documents on charcoal were gathered and reviewed. The issues reviewed included policies and legislation governing the charcoal sector, charcoal production systems, charcoal processing, environmental effects of the charcoal industry, marketing arrangements and institutional responsibilities. Furthermore, the literature review was strengthened by review of two case studies, one from Sudan and the other from Kajiado district in Kenya.

2.2 Personal interviews

Policy makers and key resource people were interviewed. Those interviewed included: The Permanent Secretary (PS) of the Ministry of Energy, Directors of KEFRI, Department of Physical Planning and Department of Renewable Energy. Others were the Deputy Conservator of Forest, the Head of Rural Planning in the Ministry of Planning and National Development, the Acting Head of Land Management Division of the Ministry of Agriculture and Director of KEFRI Forest Products Research Center.

Key institutions visited were, the Forest Action Network, Energy Alternatives Africa Ltd., Green Belt Movement, and Elangata Wuas Ecosystem Management Programme. At the district level, those interviewed were the District Commissioners (DCs) and District Foresters from Kitui, Makueni, Taita Taveta and Kwale Districts (Annex 3). In Makueni,
the District Environment Officer (DEO) was also visited\(^\text{11}\). During meeting with DFOs a checklist (annex 1) was used to ensure that all the issues of concern were covered.

### 2.3 Round table meetings

Four round-table meetings were held. The participants were technical Heads of Departments from government Ministries and other key stakeholders (Annex 4). The representatives at the meetings included: District Forest Officers, District Livestock Production Officers, District Agricultural Officers, District Ranch Officers, Kenya Wildlife Service Officers, District Social Development Officers, a Renewable Energy Center Manager, District Home Economics Officers, Officers from the County Council. NGO and Private Sector representatives included, Charcoal Dealers, a Ranch Manager, a Teen Watch representative and a K-Rep representative. Attending the district level round table meetings were also Danida representatives such as District Project Coordinators, District Agricultural Advisers, District Development and Training Officers, District Technical Officers and District Business Officers. A list of participants at the four round table meetings is attached in Annex 2.

### 2.4 Field visits

Different stakeholders were visited to give their views on the charcoal industry. They included three types of ranches i.e. one cooperative ranch (Yatta B2 Ranch in Kitui District), one privately owned ranch (Choke Ranch in Taita Taveta District) and two community ranches (Sagalla Ranch in Taita Taveta District and Lunga Lunga Ranch in Kwale District). Others visited include small-scale producers and marketing groups. Small-scale farmers were visited in Mutitu Division of Kitui District, Wote and Kibwezi Divisions of Makueni District and in Voi Division of Taita Taveta District. Roadside charcoal brokers were visited and interviewed along the Thika-Mwingi Road, along the Nairobi-Mombasa Highway and at Lunga Lunga Ranch.

### 2.5 Observations and photographic recording

While traveling keen observation of the landscape was done and relevant aspects documented. They included dominant tree species in the landscape, extend of soil erosion

\(^{11}\) Apparently, of the four districts only Makueni District has a DEO posted. The DEO is an employee of the National Environmental Management Authority (NEMA).
and the general farming systems in the case districts. Pictures were also taken to provide photographic recordings.

3. Laws, and Policies

The interpretation of law in this report is: “a rule or set of rules enacted through a parliamentary legislative procedure and enforceable by the courts. Policy in this report means an overall plan embracing the general goals and acceptable procedures especially of the government of Kenya.

3.1 Laws concerning on charcoal

The Ministry of Energy (MoE) has the official mandate to ensure provision of adequate energy in the country. No specific laws were found to govern the charcoal industry directly, but the Forest Act, Environmental Management and Coordination Act, Water Act, Trustland and Land Adjudication Act were found to indirectly relate to production of charcoal in Kenya.

3.1.1 The Forest Act

The Forest Act recognizes charcoal as a forest product but it offers no specific regulatory provisions. However, relevant provisions exist in paragraph 8a and 8b, where by it is stated that “felling, cutting, taking, burning, injuring or removing of any forest product is not allowed in Forest Areas” as well as un-alienated land.

Article 11:1a says that the authorized forest personnel can demand of any person to produce an authority or license for any act done or committed in forest areas or un-alienated land. In practice this means evidence like a movement permit. The Forest Act conveys the burden of proof to the holder of the forest product, and the forest officer can arrest anyone holding a forest product and is incapable of producing evidence that this product is not illegally obtained from the forest. The Forest Act applies in all government forest areas, i.e. gazetted forests, which account for only 1.7% of the land area in Kenya, and the un-alienated land when it comes to transport and possession of

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12 Government of Kenya, Forest Act (FA) [1992] Cap. 385 para 8a
13 Ibid, para 8b. Un-alienated land means land where the ownership has not yet been transferred to any legal person or organization.
14 Ibid, para 11,1a.
forest products. Among other responsibilities\(^{16}\) the Forest Department is responsible for promotion of community based afforestation schemes.

Presidential bans have paved the way for uncertainty in production, selling, transporting, buying and the use of this commodity. Former Kenyan presidents issued presidential bans, and the aim was banning the production and transport of charcoal whereas use and marketing was *not* banned. An important facet is that these bans were never gazetted, and thus cannot serve as basis for legal intervention. In order to discourage charcoal production, the Forest Department has made use of other legal provisions when charging arrested charcoal producers or transporters in the local courts. The Chiefs Authority Act used to be used as legal basis for trial\(^ {17}\), but it was repealed at an IPPG\(^ {18}\) in 1996. Therefore, despite the fact that some chiefs fail to acknowledge it, this act cannot be used and many people are not aware of this.

Currently a system of licensing is used. Two documents form the basis for distinguishing whether a charcoal venture is legal or not. Ideally, charcoal cannot be transported from the rural Kenya to the urban consumers unless two documents have been issued: These are a Certificate of Origin and a Movement Permit.

3.1.1.1 The Certificate of Origin

The Certificate of Origin is fairly new, it has been used for less than one year\(^ {19}\).

The Divisional Forest Extension Officer (DFEO) issues a certificate of origin after a visit and consultation to the private property where charcoal is to be produced. The idea behind the certification is two-fold: The system generates information on the utilization of the woody resource. In addition, it facilitates a constructive dialogue between the farmers and their forest extension officers\(^ {20}\). The certificate serves as opposite evidence since it certifies that the forest produce (e.g. charcoal) is *not* obtained from a gazetted

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\(^{16}\) Others include: Developing a framework of effective forest resource management, establishing commercial forests and conserving indigenous forests.

\(^{17}\) District Forest Officer of Kwale District, Mr. J.K Ndambiri, personal comment.

\(^{18}\) Inter-Parties Parliamentary Group.

\(^{19}\) Deputy Conservator of Forests, Mr. Mbugua, personal comment.

\(^{20}\) Ibid.
forest. The certificate is free of charge, but often the DFEO will be faced with practical difficulties of undertaking all these visits if e.g. there is no means of transportation. In addition, and like the case of Wote Division in Makueni District, a practical constraint to the system is that one DFEO can be appointed to cover three or two divisions because of lack of extension staff. This makes it difficult for such an officer to be effective. Producers find the Divisional Forest Office to be far for them to get certificates of origin. They would prefer to have the certificates at the Locational or Sub-locational level and also have reliable transport for the issuing officer to be able to visit farms faster.

3.1.1.2 Movement permit
The movement permit is also free of charge, but must be obtained if more than three bags of charcoal are to be transported. Once the DFEO has signed a Certificate of Origin, a movement permit is obtained from the District Forest Officer before transporting the charcoal. The division of powers between the DFEO and the DFO is a control mechanism to ensure that an appropriate system of checks and balances is in place. However, currently most of the charcoal is transported during the night without a permit\(^{21}\).

3.1.2 The Environmental Management and Coordination Act
The Environmental Management and Coordination Act\(^{22}\) (EMCA) commenced on 14\(^{th}\) January 2000. It regulates the supply of charcoal indirectly through an environmental conservation point of view. Article 38 conveys the obligation of the National Environment Action Plan through an authorized committee to set up operational guidelines for the planning and management of the environment and natural resources. Given the nature of the Act, this obligation presumably implies planning and management of sustainable supply of woodfuel, which includes charcoal. The provincial and district administrations are responsible for the proper management of the environment in their provinces and districts respectively, and the above-mentioned guidelines are to be used in the activities of Provincial and District Environmental Committees\(^{23}\) (PEC and DEC respectively). The hilly and mountainous areas of Kenya

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\(^{21}\) Several people, including DC of Makueni District, Mr. P.P. Olando, have articulated this position.
\(^{22}\) Government of Kenya, Environmental Management and Coordination Act (EMCA) [1999].
\(^{23}\) Ibid at para 30a.
have received noticeable provisions in the Act\textsuperscript{24}. In case of risk of degradation, the DEC is required to specify which of these areas are to be targeted for afforestation or reforestation programmes.

A novel and important provision exists in EMCA. It is stated that, all intended projects with a significant impact on the environment requires an Environmental Impact Assessment (EIA) to be done by authorized personnel before implementation of the projects. It is however not explained how the word \textit{significant} should be interpreted. In the Environmental Impact Assessment regulation of 2003 an EIA has to be concluded and approved in accordance with the regulations\textsuperscript{25} but the regulations still do not define the interpretation of the word \textit{significant}.

EMCA represents a progressive legislative endeavor towards managing the environment. As regards the demand side of firewood and charcoal, it has relevance by reason of granting the right for all persons in Kenya to have access to a clean and healthy environment including \textit{access to environmental elements} which includes vegetation. Charcoal is not mentioned in this context, and the applicability of this legitimated right, amid the novelty and proactive scope of the act, is uncertain. However, it is directly specified in paragraph 49 that NEMA is to promote the \textit{use} of renewable energy sources, of which charcoal is one. This shall be done through encouraging private farmers, institutions and community groups to plant trees and woodlots and creating an incentive scheme for the promotion of the energy sources\textsuperscript{26}.

**3.1.3 The Water Act**

The Water Act grants powers to the Water Resource Management Authority (WRMA) to designate an area to be a catchment area, whereby the area is conserved and protected in order to regulate the water resource\textsuperscript{27}. Moreover, the WRMA also has the powers, by

\textsuperscript{24} Ibid at para 44 to 47.


\textsuperscript{26} Ibid 49b and 49d

approval of the Minister, to designate an area as a protected area\textsuperscript{28} where by specific requirements in - \textit{and in relation to} – the area can be imposed. It is unlikely, that such designated area also could serve the purpose of supplying woodfuel concurrently.

\subsection*{3.1.4 Land laws}

Three acts on land tenure are very relevant to wood production for charcoal. There may hardly be a more stable and rooted foundation for management of natural resources in rural communities than recognized ownership of land\textsuperscript{29}. The County Councils are by provision in the Trust Land Act\textsuperscript{30} granted administration right of Trust Land, and hold it in trust for the benefit of the residents. An important aspect is the legitimate prospect of temporarily converting part of or the whole area to private land through leasing contracts. The Land Adjudication Act\textsuperscript{31} provides for a permanent conversion to private land, whereby private title deeds of former Trust Land are issued. If the private party is a group of people, the Group can register under the Land (Group Representatives) Act\textsuperscript{32}.

These laws have relevance for the production of charcoal, since tenure rights affect the undertaking of farming enterprises including charcoal production. If one does not have the tenure rights of a given area, the land can be more vulnerable to degradation, doubtlessly less planned and less controlled. The charcoal producer will also have little interest in the post-kiln landscape.

\subsection*{3.1.5 Partial conclusion on laws on charcoal}

The laws most relevant to charcoal are far from being exhaustive. It can be argued that although there are no laws for or against charcoal, the bits and pieces in various related acts can in fact be used to plan for supply and utilization of charcoal. However, there is a need to develop clearer laws specifically for the charcoal sector.

\begin{itemize}
\item \textsuperscript{28} ibid para 17-1.
\item \textsuperscript{29} Alden Wily (2002): Participatory Forest Management in Africa, an overview of progress and issues. Unpublished article from www.cbnrm.net/pdf/aldenwily_1_002_cfm.pdf
\item \textsuperscript{30} Government of Kenya. Trust Land Act (TLA) [1939, revised 1970]
\item \textsuperscript{31} Government of Kenya, Land Adjudication Act (LAC) [1968, revised 1977] Cap 284.
\item \textsuperscript{32} Government of Kenya, Land (GR) Act (LA) [1968, revised 1970] Cap 287.
\end{itemize}
3.2 Policies concerning charcoal

As for the case of legislation, there are no specific policies on charcoal production, however, policies related to charcoal are found in the draft policies of the Ministry of Energy and Forest Policy of the Ministry of Environment, Natural Resources and the officially approved policy on Environment and Development.

3.2.1 Energy policy

The Ministry of Energy is in the final stages of developing a National Energy Policy and a detailed Renewable Energy Policy. The draft Renewable Energy Policy Paper is advocating for planned sustainable supply of charcoal co-ordinated by a proposed Renewable Energy Board. If approved, charcoal will be produced just like any other cash crop in the country. Production can be undertaken by small and medium scale farmers, ranches, private companies and even on government land.

3.2.2 Kenya Forest Development Policy (n/e)

The two statements which indirectly cover charcoal in the draft Forest Policy are as stated below: “The overwhelmingly most important forest product for the country is wood energy...Strategies will be developed to realize sustainable production of fuelwood”. and “Woody vegetation on trust lands will be sustainably managed to satisfy local forest-based needs....in close working relationship between the local authorities and Forest Department”

3.2.3 Environmental policy: Charcoal and Forest Resources

The Sessional Paper No. 6 of 1999 on Environment and Development is the latest and most comprehensive policy paper on environment. Other documents, although, with very little information, are the national and district development plans. While there is a policy specific to fuelwood (4.2.2.2 k)\textsuperscript{33}, there is none specifically targeting charcoal. There appears to be a deliberate silence on charcoal with the emphasis being put on developing alternative sources of energy to charcoal (e.g. 4.2.2.2.m). However, several policies touch on charcoal indirectly. The closest is section 4.2.2.2. 0. which states, “develop and

\textsuperscript{33} The Sessional Paper No. 6 of 1999 on Environment and Development.
implement appropriate responses on the impacts of urban energy demands on forestry” and 4.5.2.d which states, “provide economic incentives for energy conservation and encourage private investments in energy development including alternative sources of energy.” Others include: section 4.2.2.2. c. on sustainable provision of forest products, 4.2.2.2. i. sustainable utilization and management of all forest lands under County Councils and national and regional development authorities, 4.2.2.2. j. “promote and manage forest plantations of both exotic and indigenous species in order to increase supply of forest-based products and services”, 4.2.2.2. n. “involve local communities and provide legal recognition to communities involved in forest conservation and management” and 4.2.2.2. p. “develop and implement appropriate management systems for both indigenous and industrial forests in view of the liberalized economic regime. The sessional paper no. 6 of 1999 emphasizes the objective of having acceptable EIA reports for all public and private projects and programmes. Although the above policy statements can be used to develop sustainable charcoal production and marketing programmes, there is need to have policies addressing charcoal as a product in order to clear the negative image clouding the charcoal industry. In fact, there is a provision for developing a comprehensive forest and energy policy (section 4.2.2.2.a and 4.5.2.a.) in the sessional paper on environment and development.

3.2.4 Land Policy and Land Use Policy
Current efforts to ensure optimal utilization of the available land resources provide a ray of hope on the problem of land degradation as a result of charcoal production. The Department of Physical Planning, which has an Environmental Management Unit, has started the process of drafting a Land Policy that will include a Land Use Policy as an integrated comprehensive part of this policy. The objectives are clear: To eliminate sub-optimal land resource allocation, manage the land resources optimally and deal with rural

35 According to the Director of the Department of Physical Planning, see below, the former Government commissioned for a Land Policy without a Land Use Policy. This part was to be developed later, but since the committee in charge of drafting the commissioned Land Policy never completed its task, the work was not useful. Therefore the Ministry has itself started an endeavor to draft on solid integrated and comprehensive policy based on “desire and commitment” to change the current situation.
environmental degradation. Regional plans have already been developed and are being implemented in some areas. The Land Policy is scheduled to be finalized by 2005.

3.3 Plans and interventions
The National Poverty Eradication Plan states that the Government will ensure that rural households will continue to have access to common property natural resources, including forested areas for fuel wood. It is not quite clear what this statement aims at, and in many rural communities it seems like a very difficult promise to keep. The National Development Plan has acknowledged the ASALs as an area where development interventions are needed because of, among others, the ecological fragility. However, the suggested interventions do not target the problems concerning the vegetation but rather: They focus on water harvesting, livestock development, drought and conflict management and infrastructure. The District Development Plans, of three of the four districts visited, have acknowledged the problematic issue of charcoal production. Taita Taveta District Development Plan however, lacks the chapter 2.4.6 on Environmental Conservation and Management. The table below, see table 3.1, presents the three districts’ plans regarding charcoal production:

<table>
<thead>
<tr>
<th>District</th>
<th>Charcoal issues in Environmental Conservation and Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitui District</td>
<td>“Charcoal burning which has reached commercial levels is the most serious environmental concern in the district. It is the biggest threat to biodiversity and a cause of land degradation. Areas that have been most affected include – North Yatta areas, especially Kwa-Vonza Location, southern Yatta, Kitui South and East areas. It is estimated that around 300,000 bags of charcoal are exported annually out of the district. Most of the targeted tree species for charcoal burning are the hard trees, which are difficult to replace such as Acacia and Balanites.”</td>
</tr>
<tr>
<td>Kwale District</td>
<td>“Felling of trees in the district for charcoal causes environmental degradation. The</td>
</tr>
</tbody>
</table>

---

36 Director of Physical Planning, Mr. R.K. Mbwagwa, personal comment.
39 Ibid at para 3.9.2.
<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makueni District</td>
<td>“Charcoal burning is one of the coping mechanisms to deal with poverty. The unabated destruction of forests (and sand harvesting from the river beds) have contributed to environmental degrading which has lead to very serious adverse climatic changes”⁴².</td>
</tr>
</tbody>
</table>

Significant differences on how the three districts address the issue of charcoal can be observed. However, none of the plans suggest programmes for sustainable supply of charcoal.

### 3.4 Partial conclusion on policies

It is a major challenge to strike a balance between satisfying the needs of the population and regulating the sustainable use of natural resources. Overall, regulating this balance can be done through adoption of an appropriate land use policy in Kenya. Currently, there is no Land Use Policy in place. Policies to clarify supply are a condition for success in maintaining a balance. The policies relating to charcoal lack coherence and coordination. Some interventions have been developed but many more guidelines must be put in place in order for the policies to have the required effect. The permit system has a lot of shortcomings and the provisions regarding EIA lack guidelines that are in coherence with the current reality and capacity. The Ministry of Energy should take the full responsibility of ensuring appropriate policies for sustainable supply of charcoal are in place. NEMA, which currently has the most proactive mandate, lacks specific policies on sustainable production of charcoal in its responsibility portfolio.

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⁴¹ Ministry of Planning (2003). Kwale District Development Plan
⁴² Ministry of Planning (2003). Makueni District Development Plan
4.0 Cooperation partners, capabilities and possible organizational structures

Very few organizations were identified at the ground level as capable of addressing the issue of charcoal. Unfortunately the legal uncertainty has hampered the establishment of these and the identified organizations mainly deal with the subject matter from an environmental conservation point of view. Few are placed in the districts, more are found operating from Nairobi. If development initiatives have to be appraised, an examination of the National Directory of NGOs in Kenya can probably be useful. Given the scope of this assessment the identification of organizations and cooperation partners has focused on national level. However, a brief mention of some relevant NGOs has been done in this report.

4.1 Cooperation partners in the districts

In Taita Taveta District the NGO’s involved in tree planting and environmental conservation include: Taita Taveta Wildlife Forum, PACT Kenya (Partners Collaboration Trust), East African Wildlife Society, Taita Taveta Ranchers’ Association, KWS and the World Vision. Kitui and Makueni -Districts have the presence of the Green Belt Movement’s tree planting programme, but the current level of engagement is low.\(^4\)

An on-going project in Ukambani, which is covering Kitui and Makueni Districts, is the Integrated Natural Resource Management in Ukambani Project. Forestry Master Plans are being developed, with the financial support of the Belgium Government, through the Belgium Technical Corporation (BTC).

4.2 Government organizations and other partners

Given the magnitude of the problem of unsustainable charcoal production, it is beneficial to outline the role of the different Kenyan institutions. The roles, as well as technical capacity, are listed in Table 4.1. In this list RELMA and Danida’s roles and capacities are also presented.

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\(^4\) Mburu, Green Belt Movement, personal comment.
Table 4.1: Key institutions (Governmental and Non-governmental) of relevance to charcoal production

<table>
<thead>
<tr>
<th>Institution</th>
<th>Current role in the Charcoal Sub-sector</th>
<th>Technical Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Energy</td>
<td>a. Policy formulation, coordination of implementation and general leadership of the sector</td>
<td>Have a technical officer at the provincial level only (One in Kitui for Eastern Province and one in Kilifi for Coast Province).</td>
</tr>
<tr>
<td>Ministry of Environment Natural Resources and</td>
<td>a. Provides extension services in the field of forestry</td>
<td>Have professional technical staff up to the divisional level.</td>
</tr>
<tr>
<td>Wildlife</td>
<td>b. Issues Certificates of Origin for charcoal production</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Issues Movement Permits on behalf of the District Environment Management Committee</td>
<td></td>
</tr>
<tr>
<td>Ministry of Agriculture</td>
<td>a. Promotes agroforestry on farms</td>
<td>Have professional staff up to the locational level.</td>
</tr>
<tr>
<td></td>
<td>b. Promotes efficient energy utilization through the Home Economics Department</td>
<td></td>
</tr>
<tr>
<td>Ministry of Local Government</td>
<td>a. Collects cess</td>
<td>Staff at the district headquarters and check points (barriers).</td>
</tr>
<tr>
<td></td>
<td>b. Provides trade licenses to charcoal traders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Leases land to investors</td>
<td></td>
</tr>
<tr>
<td>Ministry of Livestock</td>
<td>a. Provides technical guidelines for the management of range vegetation</td>
<td>The ministry works together with agriculture that have staff up to the locational level.</td>
</tr>
<tr>
<td></td>
<td>b. Issues certificate of origin in ranches</td>
<td></td>
</tr>
<tr>
<td>Ministry of Cooperative Development and Marketing</td>
<td>a. Registers production, processing and marketing cooperatives</td>
<td>Have staff up to the District Level.</td>
</tr>
<tr>
<td></td>
<td>b. Builds the management capacity of cooperatives through training of cooperative</td>
<td></td>
</tr>
</tbody>
</table>
| Ministry of Gender, Sports, Culture and Social Services | a. Registers CBOs e.g. Self Help Groups  
b. Trains groups in leadership and group dynamics | Have staff up to the Location |
| Ministry of Lands and Settlement | a. Develops land use policy and plans  
b. Enforcement of land use plans | Have staff up to the district level |
| Ministry of Education | a. Teaches tree planting and environmental conservation in schools  
b. Teaches efficient energy utilization in schools | There are numerous schools in all the districts |
| Regional Development Authorities (e.g. Tana and Athi River Development Authority and Coast Development Authority) | a. Own land in charcoal producing areas | Have the potential to develop large-scale tree plantations to produce charcoal commercially as a cash crop |
| National Environment Management Authority | a. Environment protection – Regulating Natural Resource Utilization through legislation | Will soon post staff to all districts |
| Office of the President  
a. DC  
b. Chief and Sub-Chief  
b. Police | a. Coordinating development  
b. Verifies farm ownership (Chief)  
c. Verifies tree ownership (Chief)  
d. Verifies legality of charcoal on transit (Police) | Staff up to the sub-location, Police are up to the divisional level |
| DANIDA ASP-MEDP-MFII | a. Promotes Agricultural Development  
b. Supports Micro-Enterprises  
c. Supports Micro-Finance Initiatives | Implementation of project is through the ministry line agencies at district level |
<p>| RELMA | a. Provides technical support for the formulation of charcoal policy | Operates regionally for Eastern and Southern Africa |
| NGOs | a. Creates awareness on environmental | Generally limited |</p>
<table>
<thead>
<tr>
<th>Associations</th>
<th>CBOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Coordinates charcoal trade – this was found only in Kwale district</td>
<td>a. Most are formed based on specific community needs</td>
</tr>
<tr>
<td>Limited technical knowledge</td>
<td>Limited technical knowledge and market information</td>
</tr>
</tbody>
</table>

| conservation and tree planting | staff and cover small areas like a location or Division |
| b. Supports tree planting | |

The National Environmental Management Authority (NEMA), a centrally placed parastatal body, is the overall coordinator and is expected to supervise all matters relating to the environment and advise the government on required measures. Compared with other governmental institutions, NEMA has the most instrumental role, given the proactive mandate, regarding the conservation of the environment and regulation of the utilization of natural resources.

Given the many institutions (Table 4.1) having some role in the charcoal sector, there are benefits in exploiting the advantages of individual institutions. Coordination of the activities undertaken by these institutions is necessary to avoid duplication but, forming integrated extension groups could be even more beneficial since each institution will provide its professional expertise.

44 Ibid para 9.
5.0 Charcoal production levels and systems

Although the charcoal supply figures given are just estimates, the supply levels were found to vary considerably, with Taita Taveta having the highest estimates of charcoal supply. This charcoal is produced from three different land use systems.

5.1 Charcoal production levels

The study found that about 1.0 to 1.4 million bags (35-42 Kg/Bag) of charcoal are produced from the four districts every year (Table 1). This translates to about 35,000 to 58,800 tons of lump charcoal. In Kwale, about 30% of the charcoal reported to originate in Musambweni Division comes from Tanzania while some of the charcoal produced in Taita Taveta is exported to Tanzania. About 95% of the charcoal produced in Kitui and Makueni is exported to Nairobi while a similar proportion from Taita Taveta and Kwale is exported to Mombasa. At the estimated conversion rate of 10%, about 350,000 to 580,000 tons of wood are used annually. In all the four districts, charcoal is produced from three different systems.

Table 5.1: Charcoal production in Kitui, Makueni, Taita Taveta and Kwale

<table>
<thead>
<tr>
<th>District</th>
<th>Estimated total bags per year</th>
<th>Ranch (%)</th>
<th>Small-Scale Farmers (%)</th>
<th>Gazetted Forests, Parks, Reserves (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitui*</td>
<td>250,000 - 300,000</td>
<td>10</td>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>Makueni*</td>
<td>200,000 - 250,000</td>
<td>40</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Taita Taveta**</td>
<td>350,000 - 400,000</td>
<td>80</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Kwale**</td>
<td>200,000 - 250,000</td>
<td>50</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

*Draft Forest Master Plan and 2002-2008 District Development Plan

** Estimates by the District Forest Officer

5.2 Charcoal production systems

The three main charcoal production systems include small-scale farms, ranches and government land. Small-scale farms produce the highest in Kitui (90%) while ranches produce the highest quantity of charcoal in Taita Taveta (80 %) and Kwale (50 %).
5.2.1 Charcoal from small-scale farms
While a few landowners may cut down wood specifically for charcoal so as to raise money for specific needs, woodlands are cut down mainly to give way for livestock and agriculture (Figure 5.1, 5.2, 5.3, 5.4-on pg. 38). This happens in six ways:

a. Increasing the land under cultivation (Figure 5.1- Mutitu Kitui).
b. Shifting cultivation (Figure 5.3 Mutitu, Kitui).
c. Increasing livestock grazing land (Figure 5.4 – Wote, Makueni).
d. Opening up private woodlands for leasing land for crop production (Figure 5.2 – Kibwezi, Makueni).
e. Opening up private woodland for sub-division of land to those who want to cultivate or rear livestock and
f. Harvesting woodlands specifically for income.

The net effect of the six small-scale charcoal production systems is that the natural woodlands are diminishing fast. It was observed that afforestation, reforestation, through enrichment planting, re-seeding and management of natural regeneration is possible, however, farm plans will be required for the successful management of the land resources.

5.2.2 Charcoal from ranches and organization of producers
A total of four ranches were visited (Table 2). They include the Yatta B2 Cooperative Ranch in Kitui District, Choke Ranch (private) in Mwatate Division in Taita Taveta District (plate 6), Sagalla Group Ranch in Voi Division in Taita Taveta District and Lunga Lunga Ranch in Musambweni Division in Kwale district. In the ranches, charcoal is produced as a result of clearing bushes to give way for grass. However, it is possible that due to the potential income, some of the poorly managed ranches may be allowing excessive harvesting of wood to burn charcoal specifically for income.
Table 5.2: Charcoal production from ranches

<table>
<thead>
<tr>
<th>Name of ranch</th>
<th>Ownership</th>
<th>Area (ha)</th>
<th>Potential charcoal per month (bags)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yatta B2 Ranch</td>
<td>Cooperative of 500 members</td>
<td>22,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Yatta Division, Kitui District</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choke Ranch</td>
<td>Private – one owner</td>
<td>4,500</td>
<td>Not known</td>
</tr>
<tr>
<td>Mwatate Division, Taita Taveta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sagalla Ranch</td>
<td>Community ranch of about 2,000 members</td>
<td>60,000</td>
<td>Not known</td>
</tr>
<tr>
<td>Voi Division, Taita Taveta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunga Lunga Ranch</td>
<td>Community ranch of 200 members</td>
<td>63,000</td>
<td>Not known</td>
</tr>
<tr>
<td>Musambweni Division, Kwale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Normally, company and private ranch owners invite charcoal burners to clear trees and bushes as a way of opening the ground for grass to flourish. They burn the charcoal and pay the management a fee of Kshs. 20 to 70/bag of charcoal\(^{45}\). Mismanagement especially as concerns harvesting, was observed in all the ranches visited. The ranch management complained of “over-harvesting and under-reporting of charcoal yields”. Charcoal burners are either squatters (e.g. Lunga Lunga Ranch), poor individuals contracted for the assignment (e.g. Choke Ranch see plate 4.1) or occasional poachers. The producers in Choke Ranch indicated that they do not like the work since it is very hard and they get very little out of it. Nevertheless, they did not have alternative sources of livelihoods. Most of the charcoal burners in Taita Taveta come from Makueni, Machakos and Kwale, but recently, the Taitas are themselves beginning to get involved in charcoal burning because of poverty. When there is good rainfall, farmers reported that they get good yields from their normal farming activities and income is higher than from the charcoal enterprise. However good rainfall comes only once in three years and this forces them to continue with charcoal production.

\(^{45}\) 20 Kshs was reported in Kitui District and 40-70 Kshs was reported in Taita Taveta District.
5.2.3 Production from government forests, reserves and parks
About 10-30% of the charcoal produced from the four districts is from government land. This type is produced mainly from poached wood from County Council land, government forests, national parks and national reserves. Poaching from national parks is very little because the game wardens were reported to be very strict. All the charcoal from this system is illegal.

5.3.0 Organization of charcoal producers
Small-scale private farmers produce by themselves. Producer groups occur in ranches and are generally organized on the grounds of labor support and harmonization of prices. They harvest the wood in turns for each individual. Kilns are also owned individually. It is the responsibility of the kiln owner to manage the burning process and bag the charcoal before selling it.

5.3.1 Production approaches in Kitui
In Yatta B2 ranch, contractors sign contracts to clear bushes from an agreed area of ranch land, the contractors in turn recruit casuals who cut the wood, burn charcoal, and “sell” it to them. The contractors pay Kshs. 20 to the management of the ranch for every bag of charcoal produced within the ranch. The contractor then sells charcoal to transporters, who take the charcoal to Nairobi. The ranch management reported that the system is not working optimally because, the contractors do not take seriously, their responsibility of conserving the landscape during and after production. The charcoal burners are not supervised so they tend to over-harvest. In addition, the number of bags of charcoal harvested is under-reported, thus the Ranch looses revenue. The Ranch has plans to improve supervision of the bush clearing and charcoal burning activities. They reported to have potential to produce 4,000 bags of charcoal per month generating Kshs. 80,000 from the charcoal. Tree planting specifically for charcoal is not allowed by the lease agreement. The County Council allows only livestock production in the ranch. Compared with the levy of other ranches, there is a substantial potential for improving income to

46 Several stakeholders endorsed this position and Mr. M. Lithoro from KWS held position that eco-tourism is much more profitable than charcoal is wildlife is present.
Kshs. 200,000 if the levy is increased to 50 Kshs/bag). One farm visited in Kitui had just opened new land and was abandoning an old piece of land whose fertility had diminished. Family labor was used, allegedly primary school boys, to harvest the wood and burn charcoal. The father was responsible for selling the charcoal. From observation, it appeared possible to manage the fallow land for natural regeneration or to reforest the land by broadcasting seeds from desired tree species. However, this could only be possible if the land was fenced and protected from livestock browsing. There were plenty of acacia branches within the farm, which could be used as fencing material. Given the moderately high average land size of the area (estimated at 60 acres per household), there is a good potential in sustainable management of the woodland.

5.3.2 Production approaches in Makueni
In Makueni, two un-registered charcoal producing groups were visited. The first group in Wote Division consisted of 15 young men. The second group in Kibwezi Division consisted of seven women and nine men. The groups are usually contracted to clear vegetation, bushland or woodlands for agriculture production. The wood, and charcoal, produced is therefore a by-product. All the wood is converted to charcoal and sold. If the groups are contracted to clear land that has no suitable charcoal species, they are paid Kshs.700 for every acre cleared. In this arrangement the cut wood in exchanged as payment for the labor. In both places, they were guided on the trees to cut and the ones to leave. When in commercial production, the maximum one individual can produce was reported as 40 bags (Wote) and 50 bags (Kibwezi and Mwatate) of charcoal per week. This represents a maximum weekly value of Kshs. 5,000 to 7,500 or Kshs. 20,000 to 30,000 per month. In Wote, when they have no contracts to clear bushes or woodlands, they buy trees from farmers and use the wood to produce charcoal. Large trees cost between Kshs. 200-500 depending on the size. A tree costing Kshs. 200 can produce 5-6 bags of charcoal depending on the skill of the charcoal burner.

5.3.3 Production approaches in Taita Taveta
Two ranches were visited in Taita Taveta District. Choke ranch had six charcoal camps but only one was visited. The camp visited consisted of 32 members of which six were women. The group had been in the camp for the last one year. They keep moving from
one site to another as advised by the ranch management. In the visited ranch, they pay Kshs. 40 for every bag of charcoal they produce. As in the other areas, the aim is to support with collective labor. They help each other to cut the wood, build the kiln and then leave it to individuals to manage the firing process. As in the case from Kibwezi, they also produce up to 50 bags of charcoal per week from the two kilns they establish weekly. Individuals sell the charcoal at Kshs. 150 per bag and remit Kshs. 40 per bag to the ranch management. This amounts to an income of Kshs. 5,500 per week or Kshs. 22,000 per month per producer. Their income is normally used to pay school fees, buy food and/or livestock. The group has a welfare fund, where each member pays Kshs. 50 for every kiln. If the ranches are properly managed, there should be adequate supply of wood for charcoal producers. Since charcoal is currently viewed as a semi-illegal product, production takes place in very uncertain circumstances. For example their living conditions in the camps are very bad.

The second visit in Taita Taveta was Sagalla Group Ranch in Kajira Village. It was reported that the Ranch 63,000 hectares and has 2,000 members, however there are no collective arrangements on charcoal. The farmers produce charcoal independently, making the ranch highly susceptible to degradation. The farmer visited produces between 50 and 80 bags of charcoal per month all year round along with other farming activities. There is no major seasonal variation. His conception of the area was, that the woody resource is infinite. The ranch requires special attention regards planning if sustainable production of charcoal is to be attained.

5.3.4 Production approaches in Kwale
Lunga Lunga group ranch was visited in Kwale District. It was reported that there were about 600 squatters living in the ranch with 10 charcoal camps in operation. The Ranch management board has not met for the last 10 years. As such, charcoal enterprises are occurring without any plan or order. The Ranch management charges Kshs. 500 per lorry load of charcoal. It was reported that the ranch has earned close to Kshs. 300,000 since the beginning of the year. There were fears that the income may encourage the management to allow over harvesting of wood for charcoal. Estimates on potential income were not available but considering what producers and ranch managements in
other ranches are earning, it would be substantial. The newly formed Kwale Woodfuel Association has planted 15 acres of *casuarina* and *eucalyptus* trees in the ranch. The association plans to plant more.

### 5.4 Species choice and quality of charcoal

#### 5.4.1 Choice of tree species

Any tree can be used for producing charcoal. However, some tree species are preferred to others because of the quality of charcoal they produce. Most charcoal burners cut the species known to produce dense wood. This includes:

1. *Acacia tortilis*,
2. *Acacia nilotica*,
3. *Balanites aegyptiaca*,
4. *Acacia senegal*,
5. *Acacia melifera*,
6. *Acacia polyacantha*,
7. *Acacia xanthophloea*
8. *Acacia seyal*
9. *Combretum molle*,
10. *Combretum aculeatum*,
11. *Terminalia brownii*,
12. *Newtonia hilderndrandii*
13. *Dalbergia melanoxylon* and
14. *Casuarina equisetifolia*

In areas where the preferred indigenous tree species have been cleared, the available wood is what is used. In one of the ranches in Taita Taveta District, charcoal burners were combining the good dense species with the light ones. Other species used were reported as *Eucalyptus saligna*, *Eucalyptus paniculata*, *Eucalyptus microcoris*, *Acacia mearnsi*, *Cupressus lusitanica* (Branches), *Pinus patula* (Tops and Branches) reported in Makuini District. The management of one ranch requested if a use could be found for *Commiphora africana* and *Commiphora baluensis*, which currently has no obvious uses.

#### 5.4.2 Charcoal quality

Freshly cut wood has a moisture content of about 60%. When it is sun dried for about three weeks, the moisture content drops to about 20%. The most appropriate moisture content for charcoal burning is 20-15%\(^\text{47}\). All the charcoal burners visited use fresh wood thus loosing energy in driving out the water from the wood. A study in Mukaa Mukuu

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\(^47\) Mr. J. Githomi, Director of KEFRI forest product research center, personal comment
Machakos District\textsuperscript{48} recommended a drying period of 5 weeks for acacia species to attain 15\% moisture content while a charcoal burner\textsuperscript{49} in Uasin Gishu District recommended three weeks for \textit{Acacia mearnsi}. Using the two estimates, a drying period of between 3-5 weeks could be considered as a reasonable period for high carbonization efficiency and good quality charcoal.

The heating value of charcoal is determined by its fixed carbon content. Apparently the hard woods and soft woods have fairly similar levels of fixed carbon. Information from KEFRI indicates that the calorific values of different wood species do not differ substantially\textsuperscript{50}. This means that one kilogram of charcoal from dense/hard wood and light/softwood can provide comparatively the same amount of energy. What differs is the volume (density). When hard wood is preferred it is because lesser quantities of the charcoal is required to produce the required energy.

\textsuperscript{48} Special Energy Programme Kenya – A charcoal production and research activities within the energy special programme Kenya.
\textsuperscript{49} Mr. Cheruyot – when asked to estimate the appropriate length of time to dry acacia mearnsi trees before carbonizing the wood.
\textsuperscript{50} \textit{Ibid}
6.0 Charcoal processing technologies and possible environmental implications
The factors, which determine the choice of rural charcoal processing systems and environmental implications are highlighted in this chapter.

6.1 Primary factors determining charcoal production systems
Charcoal production systems are determined by the available raw materials, time and the scale of production and the technologies available of the market.

6.1.1 Raw materials
Preference of dense hardwood trees for conversion into charcoal means that raw materials are obtained by selective felling and therefore its occurrence can be scattered and patchy. Besides physical distribution of trees suitable for charcoal making, most of the trees occur in land privately owned by individuals, cooperatives, companies or local authorities, which holds the land in trust for the resident communities. The material availability of the production systems visited does not favor charcoal conversion methods that use permanent structures.

6.1.2 Time
Different kilns have different wood carbonization time cycles. Some methods like the earth kiln take a long period, i.e. from three to nine days to carbonize wood while metal kilns take a very short time (6-8 hours).

6.2 Scale of operation and cost
The scattered distribution of raw materials often necessitates operation at a very small scale level. It is not unusual to have a production batch based on wood from only one tree. Where large quantities do arise as in land clearing, they are short lived so that permanent production installations cannot be justified.

Provided that the charcoal produced is acceptable, the production process resulting in the lowest production cost should be the most appropriate. The three major cost items in charcoal production are the wood, labor and equipment. The cost of the first item is
common to any technology employed and therefore labor and equipment account for
differences in the production costs.

6.3 Available technologies
To convert wood to charcoal, the essential requirement is provision of a chamber or kilns
to hold the wood during its carbonization. There are many different charcoal production
methods that have been used in various parts of the world. The technology used in a
given area will also depend on the technologies, which are known and are available.
In Kenya the charcoal production technologies, which have been used fall in three broad
categories i.e. (a) the earth kilns, (b) masonry kilns and (c) the metal kilns. These
technologies can all provide adequately good quality charcoal, appropriate management
is applied. Earth kilns can be different ranging from pits to mound kilns improved with
chimneys. The traditional earth mound kiln without chimney is the most commonly used
in Kenya. Charcoal yields and quality is however quite variable among the different types
of earth kilns and even between similar types. The variation is brought about by kiln
design and the skills of the operator.

6.3.1 Traditional earth kiln
Apart from Kakuzi Ltd, which uses masonry kilns, the traditional earth kiln is the
technology currently used in Kenya. This method is common due to its low capital
requirement and it can be sited near the source of wood. In operation of the traditional
earth kiln, the firewood is arranged into a stack on the ground (Figures 6.1 and 6.2). The
stacks vary widely in size and shape and orientation of wood pieces. In the most classical
arrangement, the shape of the stack is semi-conical with wood packed in the general
direction of the axis. The wood is then covered with green branches, grass or any
available fresh herbal vegetation. A layer of soil is added to make the cover as airtight as
possible. The time for burning depends mainly on the size of the stack. The bigger the
stack, the longer the firing process. This method is reported to give a recovery of between
10-15%. However higher yields of up to 20% can be achieved, when proper control of
the carbonization (air inlet) is done.
Disadvantages of the traditional earth kiln include the requirement of high level of skill in making charcoal, inferior charcoal quality due to lack of carbonization control and soil contamination.

Unfortunately, all the producers visited use the traditional earth kilns. They indicated that they do not know any other better methods. Asked if they would be interested in an improved kiln, which could give them higher yields of charcoal, producers in all the sites indicated that, they would be glad to have such a kiln but the high cost of transporting the wood would have to be taken into consideration. They also requested for consideration in provision of tools to make their work easier. For example the use of a power saw for cutting trees down and chopping into smaller pieces and also gloves to use when dealing with the thorny acacias. Charcoal producers also complained of breathing in a lot of charcoal dust when removing the charcoal and packaging it. A breather mask could be of help.

6.3.2 Improved earth kiln
The improved earth kiln is a modification of the traditional earth kiln and it operates on the same principles. However the significant difference lies with the chimneys, which are made using low gauge iron sheets. The wood is seasoned (dried partially) and tightly packed into the stack before carbonization. This kiln gives a recovery rate of 24% - 28% and the carbonization cycle takes 3-5 days depending on the size of the stack. None of the charcoal production groups visited in the case districts was using the improved earth kiln, but this may be explained by the fact that very few have heard about it, let alone seen it.

6.3.3 Casamance kiln
Casamance kiln is a modified earth kiln type, which is widely used in Sudan and it produces high quality charcoal with a recovery rate of 25-30%. Unlike the traditional earth kiln, the wood is arranged in a vertical position placing the largest pieces of wood at the center and the medium and small sized pieces around them. The stacked wood is covered with vegetation and soil. One chimney made with iron sheets or oil drums is used to improve air circulation within the kiln. This method has been tested by KEFRI in carbonization of *commiphora* species in Mwingi District. Some producers in Choke
Ranch reported that they have heard of this type of kiln, but they do not use it because it requires more skill and time in arranging than the horizontally arranged earth kiln.

6.2.4 Masonry kilns
Masonry kilns are of various designs such as the South American Beehive type that was used by EATEC\textsuperscript{51} in Eldoret and the Half Orange Kiln that was introduced in Kenya by GTZ Special Energy Programme and currently being used by Kakuzi Ltd. These kilns produce high yields of about 30\% recovery rate and give high quality charcoal. The kilns are best suited for static use where the wood can be brought to the kiln at a central point or where large volume of wood is available over a long period of time e.g. wood plantations and maybe ranches. Special skills may be required for certain designs of masonry kilns such as those needing a domed roof. The maintenance and operating labor costs are high as doors and other openings have to be constructed with each firing. Except for the Chairman of Yatta B2 Ranch none of those visited in the field had heard about and or seen the masonry kiln.

6.3.5 Other kiln technologies
Other kilns include the Subri trench and the metal kilns. Subri trench was developed in 1981 in the forest reserve “Subri River” in Ghana. The kiln is made by digging a trench parallel to the wind direction. This kiln is covered by an iron sheet, which is in turn covered by soil. Four chimneys are placed perpendicular to the wind direction to ensure homogeneous carbonization process. This method has been reported to achieve a recovery rate of 30\% but has high operation costs due to digging of the trenches and buying of iron sheets. This type of kiln could be suitable where the opportunity cost of labour is minimal.

The metal kiln can be of various dimensions and are designed for easy transportation. They range from specially built cylinders with top lids and a system of air vents (Figure 6.1) to improvised oil drums (Figure 6.3). The kiln has sections that are assembled at site and dismantled for transportation. Their conversion efficiency is about 25\% and has a production cycle of 1-2 days, which is made possible by the rapid cooling of steel walls.

\textsuperscript{51} East African Tannin Extraction Company, which is no longer in operation.
6.4 A compromise technology for processing charcoal in the ASALs
There are many types of kilns. However given the conditions in ASAL Kenya the improved charcoal kiln and the casamance appear to be the most appropriate improvements for small-scale producers. The masonry kilns could also be considered but only if farmers were to transport the wood to some central sites in a village or ranch for processing. Intensive research needs to be done to improve the earth kiln to a higher efficiency. Some ways of improving efficiency may involve very simple operations like drying the wood to the most desirable moisture content before firing. Chopping wood to the right size and training of charcoal burners on management of the firing process.

6.5 Environmental impacts
Harvesting of trees for charcoal has many negative environmental impacts. They include, diminishing stock of trees and shrubs and biodiversity as a result of harvesting the preferred species, which are mainly hard woods. Other negative effects are accelerated soil erosion, landslides, uncontrolled wild fires, accelerated surface run-off, lowered water table, reduction of animal forage and air pollution, all of which lead to ecological imbalance.

6.5.1 Diminishing species stock and biodiversity
As observed in Figure 5.1 to 5.4, and 6.7, 6.8, 6.9 it is clear that as the indigenous vegetation is cleared, the biological diversity of both the woody and herbaceous plants declines. In Kitui and Taita Taveta, Commiphora africana and C.baluensis were the dominant species in the landscape. Selective harvesting, pruning larger trees, natural regeneration and re-seeding could contribute to biological stability.

6.5.2 Land degradation
Leaving land bare without adequate vegetation cover leads to land degradation. This is through increased water run-off, soil erosion, low water table, land-slides and wild fires. Removing 350,000 – 580,000 tons of wood from the land scape will definitely leave a lot
of bare land if the harvesting is not done in a planned manner (Figures 6.7, 6.8, 6.9-pg 45).

6.5.3 Air pollution
Charcoal making in Kenya in 2000 required the pyrolytic conversion of 18.35 million tonnes of round wood equivalent, an amount that led to the emission of methane (CH₄), a greenhouse gas (GHG) of 85.6 Gg (1Gg = 10⁹g) of carbon equivalent⁵², representing 78% of all methane emitted from all fuel related combustion in the country or 4.4% of the global charcoal-making source strength that year.¹ Other GHGs emitted from charcoal production that year included 1.2733 Tg (1Tg = 10¹²g) of carbon equivalent of CO₂ and 0.2144 Gg of nitrogen equivalent of nitrous oxide (N₂O) assuming 30% moisture content).

Methane is the most potent greenhouse gas (GHG) known owing to its high Global Warming Potential (GWP). Many other products of incomplete combustion are also emitted from the pyrolytic process, most of which are also known to contribute to regional and global atmospheric pollution that leads to negative environmental impacts including climate change, increase in tropospheric ozone levels and acid rain formation, both of which damage crops and other vegetation particularly in high altitude areas.

These negative environmental effects can be minimized through planned production of charcoal to meet demand levels and utilization of more efficient technologies which will require almost half of the quantities of wood for charcoal production and at the same time release lower quantities of pollutants into the environment.

7.0 Marketing systems and price structures

The following chapter of marketing systems and price structures concerning charcoal production in Kenya relates to the production systems presented in chapter 5. Thus information on resale, end-sale or wholesale schemes will not form any substantial part of this presentation. Given the nature of the production, the focus will be on small-scale marketing systems; hence hereafter “marketing systems” denote “small scale marketing systems.”

7.1 Marketing systems

Marketing systems are the selling arrangements whereby charcoal is offered for sale in exchange for cash. The approach by individuals or collective groups during the sale is also part of the marketing system. Before going through this chapter it is beneficial to distinguish subsistence production and secondary production.

7.1.1 Supply chains and marketing schemes

The most common supply chain comprises four levels. The first is the producers level including both subsistence and secondary producers. The brokers, who form the initial step of the marketing systems, usually occupy supply chain level number two. The traders transporting the charcoal on lorries from rural ASAL to Urban and semi-urban centers form the third level, and the last level is the retail sellers, who form the last step of marketing. As mentioned the marketing takes off when the farm gate production is transferred to the brokers. Four marketing schemes have been identified, but others may exist as deviations or modifications.

a. Scheme one: This involves a producer selling to a local broker rather than having contact to traders directly. The broker operates the enterprise throughout the year, and transports (by bicycle, wheelbarrow or on back) the bags of charcoal to smaller selling points near the main road. The broker retains the advantage of local knowledge to production levels and localities. The result is that the produce is brought faster to the market, and the producers, despite receiving a lower price, are guaranteed market. The
traders do not deal directly with the producers, but accepts, for the benefit of easy access, that part of the price (Kshs. 20 to 40 per bag) that goes to the broker. The traders transport the charcoal to larger urban centers and cover other costs incurred on the way. This scheme was observed in Mutitu division of Kitui District.

b. **Scheme two:** This involves the producers themselves arranging for establishment of selling points. Scheme one and two differ in the sense that the producers receive a higher price, and have a direct contact with the traders. But since not all producers can manage delivery to these selling points, some producers are also contracted to arrange delivery for others; hence some producers momentarily act as brokers. This scheme is very common in areas where charcoal is transported for a long distance to the selling point, and is also the scheme used in areas newly opened by infrastructure. This was observed in Wote Division of Makueni District where a youth group was selling their charcoal to consumers in Wote town at the same time transporting for the women producers in the locality.

c. **Scheme three:** This involves producers (charcoal burners) contracted by a landowner (ranches or private land owners) to clear land for agricultural cultivation or livestock production. The charcoal producers are paid for their work with the wood, and they sometimes also pay rent for staying on the same land. A case was recorded, where the burners occupy a site long enough to have a season of agricultural crops on the landowners farm. A levy to the landowner is sometimes paid. Traders access the producers at the production site, where a temporary selling is established, or alternatively the producers transport the bags of charcoal to the main road and sell at a slightly higher price. This was observed in all the ranches and one large-scale private farm in Kibwezi.
d. **Scheme four** involves ranches, where a substantial amount of the charcoal comes from. Depending on the ownership profile members of the ranch can undertake production as if it was their own land. Given that the ranches often only are involved in livestock rearing the practical implications are that a system like scheme three is developed probably with a supervision of the ranch. It is very likely that a system of levy payable per bag of charcoal to the ranch is developed. Traders in this case enjoy larger scale supply as a benefit if demand is high.

### 7.1.2 Farm gate supply variations

The farm gate production level depends on several parameters (recall chapter 5.2.1 and 5.3 on production systems). Mainly lack of other income generating activities and an acute need for cash pave way for a commercial production of charcoal. Depending on the availability of woody resources\(^{53}\) one individual farmer can produce up to 50 bags of charcoal a week, however, a realistic yearly average would be around 15 bags weekly. If the production of charcoal is a bi-product of land clearing for cultivation (secondary production) the supply level depends on the nature of the vegetation in the woodland, on the available labor, and on the preference for having trees in the post-kiln landscape. The supply level will be significantly lower on average, but a maximum production level of 50 bags can be reached. For subsistence production supply has no significant seasonal variation. Labor is available, there are no major expectations regarding the post-kiln landscape, but the nature of the bushland available naturally has importance on the supply level. Generally, if wood availability is not a limitation the same number of bags could be supplied every week throughout the year. According to a charcoal survey undertaken in Ukambani\(^{54}\), there are only minor seasonal variations, indicating that subsistence production is more prevalent than the secondary production. Several forest officers share this view\(^{55}\). However only a few years back, the production was generally seen as a secondary activity derived from the agricultural system of shifting cultivation.

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\(^{53}\) Note that not all tree species can be used for charcoal. A list of suitable tree species for ASAL Kenya is provided in subchapter 5.x.


\(^{55}\) DFO Kitui Mr. A. M. Gondo
7.1.3 Supply responsibility

Due to the common uncertainty of the legality of the enterprise, all interviewed producers of charcoal showed reluctance towards disclosing any formal responsibility of supply to charcoal traders. However, through the empty bags supply system, it is evident, that in remote rural areas, where these bags are not easily accessible, it is the trader who supply the empty bags when collecting the filled ones. This implies two scenarios regarding supply responsibility:

a. **Scenario one**: This is where charcoal rarely are supplied unless empty bags are provided in return, but marketing is through any buyer (trader or broker) provided that they re-supply empty bags. The supply responsibility is *informal*, but the traders have the advantage of a fair insight in the supply capacity in a given area.

b. **Scenario two**: This is where regular buyers supply empty bags, indicating that a *formal* supply responsibility and marketing system exists. The buyer only takes the lorry to the pick up points/marketing point when charcoal is ready for picking. In this case the traders have a very good insight on supply capacity.

Depending on the level of competition between buyers, brokers or traders the second scenario will be preferred by the trader, since this gives best insight in the supply capacity. The producers have the advantage of a more regular cash flow and reduced risk of overstocking. Even in a competitive market environment it is likely that the brokers or traders divide the suppliers market between them and scenario two can thus still be prevalent. The producers are very dependent on the brokers or traders to come and buy their produce hence a certain strategic attitude of responsibility can be anticipated. Besides, bringing a lorry into remote areas of bad infrastructure involves a substantial cost of which lack of agreed pick-up points and quantities could threaten the profitability of the enterprise. This expresses the need for traders to have formal relationships with the suppliers, i.e. vertical agreements.
7.1.4 Horizontal agreements and coordination between producers.

At no time during the field visits was fully collective charcoal production identified. In some places schemes were arranged in order to collectively deal with the hardest part of the production which is cutting of the wood.

Generally there are few horizontal agreements between producers, and they are very poorly organized. The harmonization of prices is more likely a result of traders’ exploitation of the high competition between producers rather than trade agreements between producers. Furthermore, for the producers undertaking secondary production, the negotiation and bargaining capacity can be hindered due to the acute need for cash or just the desire to realize a secondary production surplus. For producers involved in subsistence production, this capacity can perhaps be relatively more advanced due to having better knowledge of the current market situation. However, since organization of producers is weak, this is hardly a significant advantage.

In Mutito Division a visit was paid to a selling point where at the time of visit 257 bags of charcoal were on display\(^5\). This indicates that producers/brokers, by securing the cash flow to the primary producers and by the endeavor of establishing convenient rural pick up points, do undertake collective supply responsibility. The consequence for the producers is that marketing is made easier, but fair pricing is not necessarily guaranteed.

7.2 Marketing constraints

In Table 7.1, the identified marketing constraints are presented. The key constraint per marketing criteria is indicated in bold.

<table>
<thead>
<tr>
<th>Marketing criteria</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>Labor intensive, in-optimal production techniques.</td>
</tr>
<tr>
<td>Market access</td>
<td>Lack of marketing organization, large competition.</td>
</tr>
</tbody>
</table>

\(^5\) Field report from visit to Mutito Division, Kitui District. Unpublished Charcoal Study Field Report.
### Input supply

<table>
<thead>
<tr>
<th>Input supply</th>
<th>Increasing shortage of preferred species, dependence on empty bags' supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy and regulation</td>
<td>Uncertain legal framework, transporters' harassments, politicians' lack of interest and commitment to improve the situation</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Burden of transport to selling points, poor roads to remote centers</td>
</tr>
</tbody>
</table>

#### 7.3 Price structures

In this chapter the prices that have been obtained from field visits and interviews will be presented. It is important to recall, that the common perception of charcoal being illegal, may have distorted the accuracy of the data. Some prices received were evidently incorrect for some reason, and have been disregarded.

#### 7.3.1 Farm gate prices

The prices at the farm gate vary considerably according to distance to semi-urban centers or tarmac road. There are also indications than rural inland ASAL prices\(^{57}\) are lower than rural coastal ASAL\(^{58}\). This difference is around Kshs. 20 higher per bag in the coast region.

The lowest price per bag in the remote areas was Kshs. 70-80 per bag (up to Kshs. 120 per bag in rainy the season) but it can reach lower than this if the producer has an acute need for cash\(^{59}\). The buying farm gate price was approximately Kshs. 120 per bag when the charcoal is brought close to the tarmac road. The same bag is subsequently sold at roadside for Kshs.180 to 200 per bag.

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\(^{57}\) From Makueni and Kitui

\(^{58}\) From Taita Taveta and Kwale

\(^{59}\) Prices were confirmed to this level through the district level round table meetings. However through in the Elangata Wuas Ecosystem Management Programme in Kajiado District female producers receive a price of 180 Kshs/bag. Included in this payment is, though, the responsibility of carrying the produce for up to 20 km to central selling points. Mr. H. Ngibuini, personal comment.
7.3.2 Farm gate price variation

The prices rise in the rainy season because of increased demand combined with reduced supply. Variation in supply is brought about by the reduced secondary production, it can be anticipated, that the subsistence production system maintains the same supply level.

A grasping reduction of farm gate prices can occur if the producers are in acute need of cash. The typical situation is the sudden need to pay school fees or a medical bill and it is mainly the secondary producers who will make this attempt. However, a subsistence producer may experience same sudden acquisition of cash and attempt to lower sale prices in order to generate income regardless of other vertical marketing agreements.

7.3.2 Royalties

In the ranches, varying royalties are paid to the ranch management. In Yatta B2 Ranch, contractors pay Kshs. 20 for every bag of charcoal produced from the ranch. In Taita Taveta Ranches, the amount varied from Kshs. 30-70 while Lunga Lunga Ranch was charging only Kshs. 5 per bag. In Lunga Lunga, after the payment is made a letter is released to the trader to take to the Divisional Office as evidence for issuing the Certificate of Origin\(^60\). Observations were also made that local residents or local enterprise authorizations are issued at the cost of the contracted charcoal producers. Prices for a permission granting rights to undertake charcoal production including the right to reside, and perhaps cultivate, varied from Kshs.1,000 to 2,000 per year.

7.3.3 Extra cost during transport.

In some districts the County Councils charge transporters a cess for ferrying charcoal. The price in one district was Kshs. 20 per bag\(^61\), and a receipt is supposed to be issued upon payment. A survey in another district indicated that only 0.33 % of the potential amount of cess was being collected\(^62\). In one district the actual price paid to the police at roadblocks was disclosed. Normally a Mitsubishi Canter type lorry carrying between 100

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\(^{60}\) The system has been developed in conjunction with the DFO Kwale, but from an interview with a Community Ranch Board Member the correct applicability of it seems uncertain.

\(^{61}\) In Kitui District.

\(^{62}\) DFO Makueni District Mr. E. Maneno, personal communication. The cess income is according to the County Council Representative Ms. Benedette Juliu used to running the Council.
and 120 bags pays Kshs 300 per load to pass a roadblock. If the lorry carries 150 bags, the price is 500 Kshs per load. One load passing four roadblocks pays between Kshs 1,200 and 2,000 to reach the final destination. In another district the amount payable to the police was reported to be between Kshs. 4,000 and 5,000 per trip to the final destination. Retailers in the urban centres also reported miscellaneous irregular payments of between Kshs. 200 – 400 due to continuous harassment. In most cases, these extra costs are passed on to charcoal consumers.

7.4 Human resources (Employment)
It is relevant also to contemplate on the equivalent number of work positions that could potentially be generated by the charcoal industry. In the current situation, whereby 2.4 million tons of charcoal (approximately 75,000,000 bags) is being consumed annually, an estimate of 167,000 man-years could cover this demand (Table 7.2). Excluded in this number of positions are all other value added positions, i.e. the brokers, the traders and the retail sellers.

Table 7.2 Human resources to cover current demand of 2.4 million tons of charcoal

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption of charcoal</td>
<td>2,400,000 tons</td>
</tr>
<tr>
<td>Equivalent number of bags</td>
<td>75,000,000 bags</td>
</tr>
<tr>
<td>Farm gate value; @ 80 Kshs/bag</td>
<td>Kshs. 6.0 billion</td>
</tr>
<tr>
<td>Annual cash requirement in rural Kenya (@ 3,000kshs/month)</td>
<td>Kshs. 36,000</td>
</tr>
<tr>
<td>Number of sold bags to cover annual cash requirements</td>
<td>450 bags</td>
</tr>
<tr>
<td>Annual potential man-year positions (6,0 mio/36,000 Kshs.)</td>
<td>167,000 people</td>
</tr>
<tr>
<td>Total human resources required to produce 75,000,000 bags annually to meet the current demand of 2.4 million tons</td>
<td>167,000 people</td>
</tr>
</tbody>
</table>

If the average retail price is set to Kshs. 400 per bag, and if it is assumed that the annual cash requirement of a charcoal dealer is double of the producers’, then the Kshs.320 profit per bag of charcoal could generate 333,000 more positions, reaching 500,000 positions in total in the Kenyan charcoal sector. Naturally these figures are based on several assumptions that need to be verified if the number of positions shall be used
formally. However, even by adapting the most pessimistic view of human resource potential in the charcoal sector, it is evident that the potential is vast.

7.4.1 Gender
Both men and women are involved in charcoal production, but it was observed that this is mainly the case, where the smaller earth kilns are used. Establishments of these kilns require less hard labor, but they also have lower recovery rates. At the broker level, women are more frequently involved (Figure 7.1; pg -57), and at the traders level some women play more significant role. Transporters were found to be mainly men and the business is carried out at night. In Kitui a private charcoal selling group had 18 of the 20 members being women.

Customs and habits also apply in this case. At production level there are indications, that women were mainly part of the secondary production, through the task of clearing land for agricultural production. In subsistence production, given the labor requirements, the indications were that men were much more involved than women. Mainly middle-aged men and the young unemployed youth were involved at this level. In Makueni it was reported that when women burn charcoal, they are not able to transport it to the distant markets. Women hire the young men to transport the charcoal for them. In Taita Taveta, six women were found in a group of 32 charcoal burners. They too were living in the bush in one of the charcoal burning camps.
8.0 Approaches to sustainable charcoal production in Kitui, Makueni, Taita Taveta and Kwale district

This chapter outlines the potential of the case districts to undertake charcoal production as a sustainable source of income. It also recommends the steps to be taken to ensure success. They include formulation of appropriate charcoal policy and legislation, appropriate institutional arrangements, development of a land use policy for the ASALs and management plans for ranches and small scale farms, aggressive dissemination of more efficient charcoal processing technologies and streamlining of charcoal marketing arrangements.

8.1 Resource and poverty status of the case districts

The absolute poverty of the four districts ranges from 42% in Kwale to 73% in Makueni. Kitui and Taita reported a poverty level of 65% and 66% respectively. The worst affected by poverty include, the aged, the disabled, small-scale land holders, land less, squatters, children and female headed households. The distribution of poverty is biased towards the marginal farming areas. Except for Kwale District, which receives a reasonable amount of rainfall, drought has become a common occurrence because of changes in the rainfall patterns. All the districts were not self sufficient in food. This makes larger parts of the population to depend on relief food.

Table 8.1: Socio-economic and physical indicators for Kitui, Makueni, Taita Taveta, Kwale Districts.

<table>
<thead>
<tr>
<th>District/Land area (ha)</th>
<th>% income from agriculture</th>
<th>% Absolute poverty</th>
<th>Women headed, households</th>
<th>Non-arable land</th>
<th>Arable land (ha)</th>
<th>Land under food crops (ha)</th>
<th>Land under cash crops (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitui</td>
<td>75</td>
<td>65 (1997)</td>
<td>-</td>
<td>1,224,100</td>
<td>816,100</td>
<td>77,700</td>
<td>2,000</td>
</tr>
<tr>
<td>Makueni</td>
<td>75</td>
<td>73</td>
<td>64</td>
<td>172,060</td>
<td>624,520</td>
<td>195,000</td>
<td>11,700</td>
</tr>
<tr>
<td>Taita Taveta</td>
<td>95</td>
<td>66</td>
<td>38</td>
<td>1,507,</td>
<td>205,540</td>
<td>12,811</td>
<td>4,037*</td>
</tr>
</tbody>
</table>
During the field visits, in all the four districts, it was reported that most people go into charcoal production when there is drought, insufficient crop yields, lack of money for family use e.g. fees, food or medical needs or when people are idle. It was also reported that the level of poverty has been increasing steadily making even communities like the Taita which normally could not go into charcoal burning to start burning charcoal for income. As indicated in Table 8.1, the four case districts derive over 75% of their income from agriculture. However, it was reported that only one out of every three years has adequate rainfall suggesting that the other two years have low or no crop yields. This calls for investment in alternative sources of income.

8.2 Charcoal as an alternative source of income
Information gathered from the field show that, since demand for charcoal is already there in the urban centers, if adequate wood supplies are availed and charcoal undertaken as a primary source of livelihood, households could earn between Kshs. 20,000 to 30,000 per month from producing about 200 bags of charcoal every month. At an estimated weight of 35 kg per bag, this adds to 7 tons of charcoal per household per month. At the expected processing efficiency of 30%, this requires 23.3 tons of wood per household per month or 280 tons of seasoned round wood per year.

The fact that poverty was reported to be highest in the more marginal areas of the districts suggests the need to intensify the interventions in such areas. As shown in Table 8.1, the non-arable areas cover a land size of about 3.7 million hectares consisting of ranches, parks, and reserves while the arable land covers 1.7 million hectares of land. Of this, only about 0.3 million hectares (23%) is utilized for food and cash crops. Some of the remaining 1.3 million hectares is used for livestock rearing and the rest is either idle land.
or is under woodlands. Therefore it is possible that over 0.85 million hectares (50%) of the under utilized arable land and the non-arable land can be available for charcoal production. This is about 85% of the total land in the four case districts.

8.3 Charcoal legislation and policy
Majority of the policy makers interviewed confessed a state of confusion as concerns charcoal and some even feared that if charcoal is legalized, there will be over exploitation hence land degradation. However, the fact that charcoal is produced from wood, which is obtained from trees, a renewable resource, and that technology is available in the country to minimize waste through processing provides the basis for strongly recommending the recognition of charcoal as a cash crop for the ASAL lands of Kenya, legalizing it and planning for its sustainable production for the good of the ASAL communities and the country as a whole.

The best way of clearing the confusion regarding the legal framework of charcoal is by enacting the Renewable Energy Bill to facilitate establishment of the Renewable Energy Board, which will in turn embark on implementation of the proposed charcoal policy. This process could start by sensitizing policy makers and legislators on the huge economic and employment potential in developing the charcoal industry. Technical facts on how implementation could be planned to master threats to environmental degradation will help in clearing the negative cloud on the industry. In addition, existing legislation and policies that hamper development of sustainable charcoal production have to be reviewed and amended accordingly. Development of policy briefs followed by a logical series of policy dialogues for the relevant policy makers and legislators could be a reasonable starting point to catalyze growth in the charcoal industry.

As the policy and legal framework are developed, pilot and sustain ably planned production of charcoal activities should be initiated to inform the policy process further. As such, demonstration trials on sustainable management of natural resources in the ranches and small-scale farms will be beneficial.
8.4 Institutional arrangements
Approaches towards a better institutional arrangement comprise four elements:

There should be village based charcoal self-help production groups with by-laws on woodland management and environmental protection. The groups should then be trained on how to manage existing woodlands, grow and manage multipurpose tree species, burn charcoal efficiently and package good quality charcoal. Members of the groups should also be able to check on each other to make sure that the by-laws are observed.

The village self-help groups should apex into charcoal producer associations at the Sub-locational, Divisional, District and National Level.

The District Environmental Committee should levy fees on charcoal and use the money for developing the charcoal industry. About 50% of the money should be used to fund charcoal production projects through the Forest Department or the District Joint Extension Teams. About 30% of the money should be allocated to KEFRI for species, processing and marketing research and the rest, 20% used for regulation of the industry to ensure sustainable management of the tree resources.

The Ministry of Agriculture staff should work together with the foresters to implement tree planting projects specifically for the market.

As recommended during the review workshop, the District Environment Committee (DEC) should take responsible for coordinating implementation efforts at the district level with an outreach network reaching the sub-locational level in order to provide more effective technical advise, provide more reliable information and monitoring of the supply of charcoal.
At the district level, the current capacity of NEMA is weak. Substantial investments should be allocated to NEMA to build its technical capacity for regulating the charcoal industry.

8.5 Production
Ranches should be helped by the Ministry of Livestock Development, Department of Physical Planning and Development Partners to develop land management plans. This will enable them utilize their land optimally. This could include management of natural vegetation through selective harvesting, pruning of larger trees and shrubs, allowing natural regeneration of coppices, enrichment planting, re-seeding of the natural lands, planting of woodlots and plantations of indigenous tree species where possible. Pilot, well-managed production activities could be initiated in a few of the ranches e.g. two ranches per district to generate lessons for developing better plans.

Small scale farmers on the other hand should be assisted by Divisional Joint Extension Teams\(^\text{63}\) to develop individual farm plans to be used for optimal management of their farms including the woodlands and deliberate planning for charcoal production. As for the case of the ranches, this must include management of natural vegetation through selective harvesting, allowing natural regeneration of coppices, enrichment planting, woodlots and plantations of indigenous tree species where possible.

Increased land productivity should be enhanced through agroforestry practices, irrigation schemes and apiculture where feasible.

8.6 Charcoal processing kilns
There is need to introduce efficient charcoal production methods which are simple, affordable and easy to adopt by charcoal producers to improve or replace the in-efficient traditional earth kiln, which yield only 10-15%. This could reduce the wood needed for charcoal production by more than half. The improved earth kiln developed by KEFRI

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\(^{63}\text{Composed of the main extension providers who are the Ministries of Agriculture, Livestock, Environment, Social Services and the Local Government.}\)
should be disseminated extensively and KEFRI and collaborators should carry out more research to improve the efficiency of the improved earth kiln. The conical design of Sudan (Casamance kiln) should also be tested and disseminated in Kenya as an addition to the basket of technologies. Masonry kilns of different sizes could also be tested where farmers are willing to bring wood to charcoal processing centers.

Appropriate information packages should be compiled and provided to charcoal producers as concerns appropriate drying period for different tree and shrub species, appropriate size and size compatibility, age of wood, wood arrangement in the kiln, optimal kiln size and shape (rectangular, triangular, conical) to match with time and management capacity of charcoal burners.

Besides kilns, a training programme should be developed for charcoal burners. This should also include the use of equipment like the power saw for cutting down and chopping into desired sizes only where labor is a constraint. The use of protective clothing like cloves, shoes, breather mask should also be considered. Just as is the case with other cash crops like tea and sisal, the housing conditions of the charcoal burners in ranches or large-scale farms should also be improved.

8.7 Marketing arrangements
To ensure a fair distribution of revenue along the production-marketing chain, organized marketing of charcoal is necessary.

At the small scale-farm level, charcoal producers should form charcoal producers associations in order to coordinate production and increase their bargaining power. The charcoal producer associations should then open charcoal collection centers at the sub-locational level. All farmers producing charcoal have to sell their charcoal at these centers. For ranches, each ranch should have several charcoal collection points located as near the main road as possible. Selling through any other location including roadside selling should not be allowed. This will help in monitoring illegal harvesting and provide the highly needed information on supply.
Standards on charcoal should be developed in consultation with all the stakeholders and enforced. Charcoal could be sold by weight in order to protect the consumers. In such a case, high quality denser charcoal will be a smaller volume than the light charcoal from the less dense species like the commiphora.

Charcoal transporters should be required to buy charcoal only from the designated buying centers. A one-stop fees/levy/cess charged on each bag, should be paid by transporters to the District Environmental Committee at the time of obtaining a movement permit. No illegal levies should be demanded anywhere else. Spot-checks should be conducted by NEMA inspectors along the transportation routes, to monitor illegal transportation.

The urban charcoal traders should also have an association to coordinate activities in the towns. The association could mainly coordinate acquisition of information on demand of charcoal, the delivery system of charcoal by transporters and harmonize the prices. The association in collaboration with NEMA should also be able to monitor illegal charcoal on the market.

The charcoal producer and marketing associations should have a savings and credit programme to encourage savings and also provision of development loans for investing in tree growing for charcoal or in charcoal trade.
9.0 Conclusion
The study concludes that charcoal in the absence of a suitable and affordable substitute for charcoal, charcoal use will continue. It is therefore advisable to plan for sustainable supply of charcoal instead of banning its use or doing nothing about it. Charcoal is a promising cash crop for the ASAL areas of Kenya. Efforts should be made to supply adequate quantities. This could be achieved by undertaking the following:

a. Information gathered in this study shows that charcoal can be developed as a cash crop in the ASAL lands of Kenya generating an income of between Kshs. 20,000 and 30,000 per household per month if it is taken up as a full time livelihood activity.

b. Given that 84 % of the total land area in Kenya is ASAL with relatively fewer enterprises competing for the land, charcoal production has a huge potential of being adopted as a sustainable land use system as opposed to if it were to be promoted in the high potential areas where competition for the land is very high.

c. There are no laws for or against charcoal. Principally, charcoal is not illegal, but the common perception portrays it as illegal. Even though there are no specific laws and policies governing sustainable charcoal production, related laws and policies, which can be used for developing the industry, exist. However for order and the long-term considerations, specific legislation on charcoal should be formulated to supersede the current amalgam of related provisions that lack clarity. Overall, there is need to create awareness of the legal status of charcoal and plan for its sustainable production especially in the ASAL areas.

d. Analysis of the many institutions involved in the charcoal sector reveals that there is currently a considerable lack of capacity and coordination to deal with sustainable supply of charcoal. At the district level coordination should be done through a cross-sectoral body like the District Environmental Committee based on a broad consensus of the stakeholders with NEMA as the regulatory body of the industry.
e. Ranches and small-scale farms were found to be the main sources of charcoal. Both the ranches should be better managed with the help of Land Management Plans, because they contain huge resources for the sustainable supply of charcoal. The current situation in many ranches is appalling, and the potential of reducing pressure on other ecologically sensitive areas cannot be attained at the current level of management. Small-scale farms also have a potential of supplying a substantial amount of charcoal, thereby generating rural income. But they too require proper management through well-planned farm management plans.

f. Only the traditional earth kilns were used in rural charcoal production in the districts visited. Improved earth kiln technologies indicate that about 60% of the amount of wood currently used could be saved, but no adoption of these technologies was observed. Lack of knowledge among producers is suggested as a major explanation for this situation; hence intensive awareness initiatives should be undertaken, in order to deal with the current negative environmental impact on the natural woodlands.

h. Over-harvesting of preferred tree species for charcoal production leads to diminishing stock of indigenous trees and biodiversity. Natural regeneration, by use of enclosures or direct sowing of seeds from indigenous tree species, should be pursued to balance demand and bio-diversity.

i. The common perception of charcoal is that it is a very sensitive issue. The marketing systems are therefore currently disorganized and not transparent. Formal selling points should be established to provide ways to regulate and monitor the supply. Another benefit to be pursued is more fair allocation of the revenue along the supply and marketing chain.

j. One recommendable approach would be to start demystifying charcoal and bring it on the political agenda, through charcoal policy briefs, dialogue and good examples of sustainable charcoal production. A package of solutions must be offered in order to deal with the multitude problems of the charcoal challenge. This package should include extension services, farm and ranch plans, micro-finance services, marketing structures
and improved processing technologies. However, this can only succeed in an enabling policy and legislative environment.

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Recommended further reading:

Government of Kenya Publications:


General documentation:


