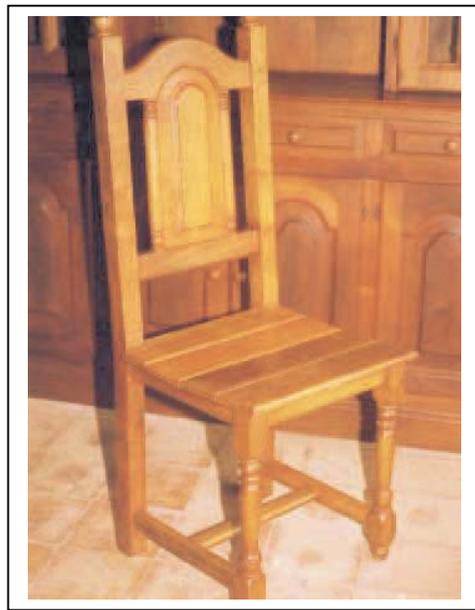
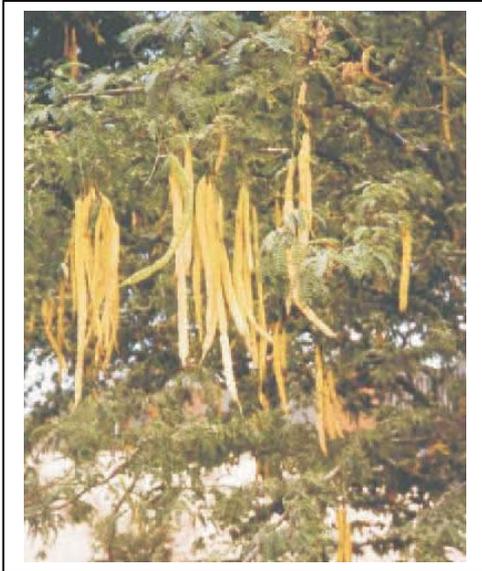


MARKETING OF PROSOPIS PRODUCTS IN THE UK



FEASIBILITY REPORT October 2006

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Feasibility Study on the Marketing of *Prosopis* Products in the UK

This report is an outcome of a project of the Henry Doubleday Research Association (HDRA), to support communities to manage and utilise the *Prosopis* tree as a resource for halting the degradation of arid lands and at the same time providing livelihood goods and services. Two communities in Baringo District were trained in the management and use of *Prosopis*, and a recipe book for *Prosopis* pod flour was also produced. The project was funded in 2006 by Kennington Overseas Aid.

The report assesses the potential for the export of *Prosopis* products to the UK, and in the process has attempted to connect interest groups in the supply chain for a practical outcome. The desk study comprised a literature review and use of the internet. A survey of timber users was carried out through semi-structured interviews (by phone, e-mail and in person). Both small and large-scale enterprises were interviewed in order to gain a perspective on the relatively unknown market for *Prosopis* products, using the interview guide in Appendix A.

The author would like to gratefully acknowledge the support, comments and advice provided by Simon Choge, Peter Felker, Nick Pasiecznik, Phil Harris, Melissa Harvey, Natalie Geen, Gemma Sutton and Julia Wright, as well as by all the interviewees.

Cover photos

Top left: *Prosopis* pods in tree (G Cruz)

Top right: *Prosopis* tree (N Pasiecznik)

Bottom left: Mesquite (*Prosopis*) flour (Casa de Fruta)

Bottom right: *Prosopis* chair (P Felker)

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1) Background

The deciduous, perennial *Prosopis* group (genus) of trees are native to the Americas (where they are known as mesquite or algarrobo), but have now become established in arid and semi-arid regions of Africa and Asia. They are fast growing, thorny, salt tolerant and drought resistant species that can grow in areas receiving as little as 50 mm rainfall per year.

The first documented introduction of the tree into Kenya was in 1973, when seeds were imported from Brazil and Hawaii to rehabilitate quarries in the saline soils near Mombasa (Jama & Zeila, 2005). The main species introduced to Kenya were *Prosopis juliflora*, *P. chilensis*, *P. pallida*, *P. alba*, *P. pubescens* and *P. tamarugo*. The districts most affected by the introduction of *Prosopis* in Kenya are Garissa, Wajir, Mandera, Baringo, Turkana, Taita Taveta and Tana River. Most of the varieties in Baringo District, Kenya, are hybrids of *P. juliflora* and *P. pallida*, but *P. juliflora* is the dominant one, estimated as comprising over 90% of overall distribution in the country (S. Choge 2006, pers. comm. 13 September).

From the opportunistic perspective, *Prosopis* trees are drought resistant and can help to stem desert encroachment by growing where virtually nothing else will. They provide a useful resource for poor communities because they require low investment to develop and manage. In addition, they can improve the livelihoods of desert margin communities by providing shade, high quality timber and firewood (Geesing *et al.*, 2004). During the lifecycle of *Prosopis*, nutritious human food can be derived from its pods.

However, there is controversy about *Prosopis* species in many parts of eastern Africa. Thirty years after its introduction to the drylands of Kenya, there is now increasing concern about its negative impacts. The very vigour and competitiveness of *Prosopis* species make it a formidable invader of other land use systems such as grazing lands. In fact in Africa, *Prosopis* is the species of the politically disenfranchised: those who do not have the means to undertake or demand development research into identifying uses and markets for this locally-abundant species, and who are vulnerable to influence from the formal environmental and biodiversity conservation sectors which, unaware of its positive uses, take an eradication approach to the situation. Yet experience from other countries shows that it is extremely difficult and costly to eradicate once it becomes established. A more practicable and sustainable solution in such areas would be more effective

management through utilisation and harvesting of marketable products, along similar lines to the local mesquite-based economies in Latin America.

With so many *Prosopis* trees already planted, and spreading widely through natural regeneration, the issue is arguably how to make best use of them for the resource-poor communities in which they grow. Production, processing and commercialisation of *Prosopis* would not only add economic value to arid zones and help to ameliorate desertification, but it would also help to improve the livelihoods of communities on these margins.

This study addresses the need for more knowledge and understanding of marketing of *Prosopis* products for Kenyan farmers/smallholders. The objective is to assess the potential market for high value products that can be operated and/or benefited by this target group.

2) Properties and commercial applications of *Prosopis*

***Prosopis* as a multi-purpose resource**

Prosopis has the technical timber and pod qualities, and environmental attributes, to be a species of worldwide commercial importance. Demonstrable successes with *Prosopis* products include firewood, charcoal, building materials, floor tiles, furniture, and handicrafts. Other potential opportunities involving non-wood products include processing for livestock feed, human food, possible medicinal value, gum production, and tannin extraction (Aboud *et al.*, 2005).

Prosopis trees are the source of multi-purpose, valuable products. In the Americas, there is a history of using all tree parts, for example, tree products from *P. pallida* include wood (for timber, posts, poles, chips, charcoal, firewood) and pods (for fodder, flour, syrup, honey, resin gums, fibres, tannins and medicines). From Mexico to Peru, people have developed local economies based *P. juliflora* and its products. Pods are stored year-round for fodder and may be made into flour or nutritious syrup. Honey is made and gums are collected. Products are either for family use or for sale in local markets. In Colombia and Venezuela, *Prosopis* is sometimes referred to as 'maíz criollo' ('local maize'), indicating its importance as a nutrient source for either man or animal (Pasiiecznik, 2001).

Wood

The wood is probably the single most important natural resource from *Prosopis* species for either fuel or for construction purposes. As a timber it can be used for poles or round wood, or cut into boards and cants. *P. juliflora* can grow up to 10 metres tall, with a trunk up to 1.2 metres in diameter (Jama and Zeila, 2005). Growth rates of *Prosopis* trees in Kenya have been estimated at 1.5 cm per year in diameter, giving rise to a tree that is about 40 cm in diameter after 25 years (N. Pasiiecznik 2006, pers. comm., 7 September).

In terms of supply, there is an estimated minimum of 10,000 hectares of land with *Prosopis* trees in Kenya (N. Pasiiecznik 2006, pers. comm., 7 September). Sustainable productivity is in the region of 1 m³ per hectare per year, with a total national yield of about 10,000 m³ annually (*ibid.*).

Prosopis logs are typically short in length (less than 6 foot), twisted and small in diameter (less than 12 inches). Therefore it has been posited that *Prosopis* is not well suited to planking, which needs a minimum of 6 foot. *Prosopis* wood also exhibits considerable variability and has unique features such as radial cracks, ring shake,

bark pockets and irregular swirling grain (Felker & Anderson, 1994). Above-ground portions of *Prosopis* have considerable figure that is attributable to twisted trunks, low-lying crooked limbs, mistletoe, branch suckers and crotch pieces. Many of the highly figured pieces are associated with knotholes and cracks, although these can be attractively filled with a clear casting resin.

Tree species of *Prosopis* have the potential for producing larger volumes than shrub species and straighter branches and trunks. Larger branches and trunks yield a high quality timber comparable in attributes to Indian rosewood or other commercial hardwoods (Pasiiecznik, 2001). While shrub species cannot be used for timber production, they may be browsed occasionally by stock, and their leaf litter improves soil quality (Pasiiecznik, 1999).

The heartwood is dark red to dark brown in colour, very distinct from the much lighter, often yellow-coloured sapwood, which is generally much more susceptible to attack from insects and is more quickly degraded. The colour of the heartwood tends to be lighter when freshly cut, taking on a darker, more intense colour after exposure to light. Although the wood is hard and heavy, it generally works well and takes a good finish (Pasiiecznik, 2001).

Prosopis wood products have added value if processed, such as by turning firewood to finished timber or into furniture. The heartwood of *Prosopis* is strong and durable, hard (harder than oak and 1.75 times harder than teak) and heavy, making it suitable for high-quality furniture.

Wood density is in the range 700-1200kg/m³. The specific gravity of wood of different species is given as 0.7-1.0, and the wood has been termed "wooden anthracite" because of its high heat content: it burns slowly and evenly, holding heat well. Many of the residents of north-eastern Kenya are using *Prosopis* charcoal because of this quality. The wood and the charcoal have large quantities of aromatic hydrocarbons and impart a pleasant taste to food, similar to hickory or beech. It is widely exported from South America to the USA as the popular 'mesquite charcoal'.

Prosopis wood is perhaps the most dimensionally-stable of all woods in having equal radial and tangential shrinkage values of only 2%-3% and in having total volumetric shrinkage values of 4%-5%. This results in less shrinkage and cracking, and abundant wood elements give high tensile strength. Other fine woods i.e. oak, cherry, walnut, teak, mahogany and Indian rosewood have volumetric shrinkage values in the range of 8%-15%. The result of the low shrinkage value is that furniture made from *Prosopis* will have less expansion

and contraction when ambient humidity levels change, such as from summer to winter in northern regions. Thus furniture will not crack and drawers will not stick with changing humidity levels (Felker, 1996).

Prosopis has potential uses in the wood carving industry, parquet flooring / tiles, high-value furniture, fibreboards and railway crossbeams. It is rarely used in large-scale construction, however, because most trunks are not straight or long enough.

Pod flour

Fruit pods are high in sugar and protein and are a rich food source for humans and animals. Felker (1996) reports that 'extensive anthropological data on human food uses of *Prosopis* pods and food technological experiments have demonstrated conclusively the potential of mesquite pods in human food preparation'.

Prosopis pods played an important role in the Sonoran desert in North America, where Native Americans made flour and dough with the dried or toasted pulp from ripe pods. *Prosopis* pod flour is being sold for between about \$20 and \$30 per kg by companies in America such as *Casa de Fruta*.

The flavour and fineness of grind relates to whether the pod flour is made from the entire ground pod (including the shell) or only the mesocarp (hull) fraction. There is some debate over whether pod flour from the predominantly *P. juliflora* and the hybrids can compete on the world market, either whole or mesocarp, with *P. pallida* and *P. alba* which are said to have a much finer grind and better aroma (P. Felker 2006, pers. comm., 21 September). *P. juliflora* pods are bitter, and pod flour is almost always made from the endocarp only, i.e. seed and seed capsule removed. It has been suggested that *P. juliflora* flour and meal have little chance of penetrating the international market, given the much superior flavour and fineness of grind of the mesocarp material from *P. pallida* in Peru or *P. alba* from Argentina.

Nevertheless, whilst some believe that the *P. juliflora* are too bitter, preliminary results from milling and consuming *P. juliflora* are positive. In Kenya, and specifically Baringo District, the majority of *Prosopis* species are hybrids of *P. pallida* and *P. juliflora*. Cooking experiments using *P. juliflora* whole pod flour in Baringo district found that the bitter taste of the seed and seed capsule flour was sufficiently 'diluted' when the flour was mixed with other ingredients. This approach enabled inclusion of the high protein part of the pod and helped to avoid a time-consuming processing stage.

(Note that sanitation is a serious health issue that should be addressed whether or not the whole pod is ground or not.)

Current milling of the pods in Kenya is done by a simple tractor-operated grinder which grinds both seeds and mesocarp. Sieves sort the flour according to size – with finer flour being used by humans and coarser flour for livestock. For human consumption, the milling needs to be repeated using a maize mill, and then sieved using a domestic sieve.

A coffee substitute has been made from *P. juliflora* in Brazil, with the roasting of only the coarse pulp flour giving a better flavour than roasting the whole pods. The final product is used in the same way as filter coffee granules. It is well accepted by consumers in terms of flavour, and in addition is caffeine-free.

Syrup

A concentrated sugary extract, or syrup, from *Prosopis* pods, called 'algarrobina', is commonly made from *P. pallida* in rural areas of northern Peru. 'Algarrobina' is consumed in different ways. In Peru, it is recommended taking a spoon daily as a health food, either consumed directly or added to fruit juices or milk, where it acts as both sweetener and flavouring agent. It is believed to have fortifying and revitalising properties and therefore is often given to children and elderly people. The syrup is also used as an ingredient in home confectionary and to prepare a tasty drink, the 'cocktail de algarrobina', which is a mixture of a small quantity of 'algarrobina' with brandy and milk (Cruz, 1999; in Pasiiecznik *et al.*, 2001).

Other products

Prosopis flowers are an important source of pollen and nectar, and native pollinators are attracted to their bright colours, making them important in apiculture. Honey produced from *Prosopis* flowers is of high quality, as is gum. The exudate gums from the trunk and branches can be used in various industrial sectors such as food, pharmaceutical, chemical and manufacturing. The gum forms adhesive mucilage and can be used as an emulsifying agent in confectionary and for mending pottery.

Other *Prosopis* products include tannins, dyes, and living fencing. The bark is rich in tannin and can be used for roofing. *Prosopis* is a folk remedy in some arid zones of the world for catarrh, colds, diarrhoea, dysentery, excrescences, eye problems, flu, colds, hoarseness, inflammation, itch, measles, pinkeye, stomach ache, sore throat and wounds. Finally, useful services provided by the tree include shade, soil stabilisation and carbon sequestration.

Summaries and market briefings on the main commercial applications of *Prosopis* – wood and pod flour - are given in Appendices B and C respectively.

□) **Review of current domestic and international trade in *Prosopis* products**

Localised and domestic markets for multiple products

Products from *P. juliflora* and *P. pallida* are important commodities in local economies of many parts of the world. They are primarily sold unprocessed but also, increasingly, as processed and packaged goods. By far the main commodities traded at present are firewood, fuel wood and charcoal for domestic and light industrial use. Trade in *Prosopis* firewood and charcoal provides a substantial part of family income for rural populations in many arid and semi-arid areas where *P. juliflora* and *P. pallida* are common, such as in India, Pakistan, Sudan, Brazil, Peru, Haiti and Mexico.

Trading in round wood and sawn timber occurs only at a very minor and localised scale at present, mainly in native ranges in the Americas but also where *Prosopis* has been introduced. There is also some local trading in other non-timber forest products, mainly honey and exudate gums from *P. juliflora* and *P. pallida*.

Trading of pods and pod products, generally as animal feeds but also, increasingly, for human use, is important in Peru, Brazil, Mexico and India. Coffee substitutes or 'café de algarroba' are produced and successfully commercialised in Peru (Pasicznik *et al.*, 2001).

Commercial-scale and international lumber markets

Prosopis pod and wood products have been widely commercialised in the USA and Argentina for many years, and to a lesser extent in other American countries. For example, Argentine Fine Hardwoods in the USA produces and imports several species of *Prosopis* (*P. nigra* and *P. alba*) from northwest Argentina, paying suppliers between \$2.50 to \$3.50/board ft Freight On Board (FOB) for clear, kiln-dried *Prosopis* wood, depending on dimensions.

The *Prosopis* or 'mesquite' lumber and flooring industry in semi-arid Texas has grown over 15 years to gross sales estimated at between \$5 and 10 million annually (Felker, 1996). If the lumber is priced equivalent to cherry, walnut, and premium oak, at \$3,000/thousand board ft, then it is worth approximately \$1700/t.

In Africa, international trade in *Prosopis* timber is, at the time of this report, limited, although Cape Verde exports *Prosopis* hardwood to Senegal. As noted later in the report, Birgir Juell and others in the USA were, at the time of this research, anxious to purchase end-grain flooring (see Appendix E) at a price of no less than \$2 per

square ft, for half inch thick flooring. However, a major hardwood flooring manufacturer in Nairobi, Kenya was, at the time of this report, pricing hardwood flooring far below international prices in the USA (at about \$200 / m³ or less). This may be due to the lumber being imported from other African countries, where it may not be sustainably produced.¹ In this respect, sustainably-produced *Prosopis* lumber may not be able to compete with similar, currently-available products on the domestic market, and therefore it may be necessary to focus exclusively on international markets. However, a deeper analysis is required on the actual costs of current domestic *Prosopis* lumber products.

Flooring

The highest and arguably most appropriate use of *Prosopis* appears to be in solid wood applications (Felker, 1996 – see also Value-added table in Appendix D). *Prosopis* is particularly suitable for flooring, and celebrities such as Sandra Bullock and Bill Gates are reputed to have *Prosopis* flooring. Although relatively labour intensive to produce, this type of flooring is conducive to the high yields obtained from small logs, by making a perfectly square cant out of the centre of the log with a joiner and then slicing off half inch pieces from the cut end. This end-grain flooring can be produced from branches as short as 30 cm if the diameter is large enough to yield clear heartwood. Specifically, the log resource needs to be a minimum of about 30 cm long and about 22 cm in diameter to obtain a 7.5 by 7.5 cm clear heartwood². The technical issues associated with the production of tongue-and-groove flooring from short pieces of lumber (including end matching, sharpening side profile knives, sniping of top surface with boards less than 50 cm) all make end-grain flooring a much more appropriate choice.

The major technical problem with end-grain flooring is in ensuring the pieces are uniform in size and within the tolerances for squareness. Problems have been encountered in laying flooring, when the installer reaches the far side of the room to find that the flooring could not be matched due to cumulative errors in piece size. Thus the first step in end-grain flooring production is to produce a cant that is within tolerances for 90 angles. This can be

¹ Industry sources in the US calculate higher production costs for lumber that is grown for 30 years with a rate of internal return of at least 8%, and then harvested, sawn and transported.

² Based in Texas, an ad-hoc flooring committee strongly recommended that no sapwood be permitted on any flooring due to the different contraction coefficients. This difference might cause flooring with both sapwood and heartwood to bend on drying. In addition, the presence of sapwood would also be conducive to powder post beetles, which can move from *Prosopis* sapwood to infect any wooden household items made of Ash.

done on a jointer after a rough cant is produced. With access to more sophisticated equipment, logs can be canted with a horizontal bandsaw and scragg mill.

Temperature and moisture levels are important in the process. Texas-based producers of end-grain flooring experimented using an insulated room approximately 3 m by 3 m with a simple heater and thermostat to control the temperature up to about 65⁰C. End-grain sections were placed in chicken-wire baskets which were then placed in racks and dried at temperatures of 45 to 60⁰C over several days. Due to the excellent 3 dimensional stability of *Prosopis*, these flooring pieces did not crack or deform. The wood should be dried to about 10% moisture. Tests by Lignomat found that the 'hickory' setting on their moisture meter most closely resembled that of *Prosopis*.

Other wood products

Prosopis wood is also being used in furniture making and fine carpentry. Due to the exceptional 3 dimensional stability and hardness of *Prosopis* wood, it is possible to make such items with finer tolerances (meaning less warping and sticking as humidity levels change) and greater smoothness of finish than other luxury hardwoods. A medium class jewellery box would retail for about \$70, whilst finely crafted boxes with inlaid woods of other colours and with small drawers, would retail for about \$200³. These boxes can be made from about 3 bd ft of lumber. Due to its unique characteristics, it is important to have persons familiar with *Prosopis* to undertake the manufacture, though with proper training, it would be possible to produce international quality goods in Kenya.

Owing to its high dimensional stability, *Prosopis* also lends itself well to instrument making. For example, two types of *Prosopis* are already being used by *Humbrook Custom Basses and Guitars*: exceptionally straight grained, knot and blemish free pieces for neck blanks and beautifully burlled pieces for body tops. According to the company website: "*The density of the Mesquite, when applied as a 1/4" top over a core of lighter Mahogany or Spanish Cedar, adds brightness and attack to the sound of the instrument to compliment the long, mellow sustain of the body woods. This gives you a complex combination of tones which is rich in harmonics and attack, lending a punchy, but still sonorous voice to the guitar*".

Certified products

Certified environmentally- or socially-sound production systems have expanded in recent years in response to increased consumer

³ High value end products, such as small jewellery boxes, are sold upwards of \$200 by Bill Smith in Washington, USA.

demand. Organic foods, Fair Trade goods and sustainably managed forest products are the main examples, but there is scope for the promotion of goods from arid zones as 'greening the desert'. Generally, Fair trade means transparency, respect for community dynamics, fair pricing, managing expectation and maintaining a social fund. Fair trade is also beneficial for distinguishing the product, acknowledging the actors and providing niche market access.

Forest certification is a market-led approach that allows the ethical consumer to buy an environmentally and socially sustainable wooden product. It includes Forest Stewardship Council (FSC) certification, Tropical Forest Trust (TFT) certification and the pan-European Programme for the Endorsement of Forest Certification schemes (PEFC). FSC certification can take 3-4 years to obtain, and therefore 'Verified Progress' is the label given to goods that are in the process of conversion to FSC (M. Packer 2006, pers. comm., 30 September). In the UK, the Soil Association is developing organic standards for wood products.

□) Current UK markets for *Prosopis* products

There does not appear to be any current trade in *Prosopis* wood or pod flour in the UK. The only *Prosopis* products currently being marketed in the UK are Kettle 'mesquite-smoked crisps' and Sainsburys 'mesquite-smoked chicken pieces'.

Import fluctuations

Although not used by mass markets in the same way as sawn softwood, the variety and choice of different species of sawn hardwood is reflected in the relatively high volume imported, compared to domestic species. According to the Timber Trade Federation, in 2005, 94% of hardwood timber (660,000 m³) consumed in the UK was imported, in contrast to 6% (54,000 m³) of hardwood produced domestically, although only 1.3% of consumed timber originated in Africa. In the same year, the value of UK consumption of hardwood products was £204 million (699,000 m³), comprising 8% of all wood products by value, and 4% of all wood products by volume (TTF, 2005).

Timber markets are variable, and volumes of imported timber and panels were relatively depressed - down by 13% in the first five months of 2006 over 2005, although there appeared to be signs of improvement (TTF, 2006a). The expected improvement was dependent on the levels of demand from timber-using markets. Trade reports indicated that specific markets have used substantially less volume of timber and panel products in 2006, largely due to structural change in the new home building market. For example, a move away from detached dwellings to apartment developments has resulted in lower demand for a number of timber products, including fencing and decking. Another area of weak demand is the reduced amount of repair work being carried out in 2006, both professional and DIY. Supply-side considerations include deliberate policies amongst companies of reducing stocks to help keep costs under control. Hardwood imports from Africa in Jan-May 2005 were 36.1 m³, whilst for the same period of 2006 they were 30.7 m³ (a 15% volume decrease). This decrease is lower than that of hardwood imports from Oceania.

From a brief analysis carried out by the Timber Trade Federation (2006a), two forces were working against any improvement in timber markets: a contraction in both financial resources and in the supply and demand of and for timber products. Further, and in contrast to those for softwood, distribution channels for certified hardwood are still poorly developed, availability is restricted, and premiums are still widely demanded (HDRA, 2005).

UK importers and supply chains

In the UK, most hardwood is imported by specialist timber importers and merchants, with only a few major users of hardwood importing direct. A handful of companies dominate the imported hardwood volume (*Timbmet, International Timber, James Latham* being the main ones) but there also exists a huge number of smaller companies many of which concentrate on specific countries or regions or even single end uses or species (N. Boulton 2006, pers. comm., 27 September). For example, tropical hardwood importers *Clarks Wood Company Ltd*, import standard hardwoods from Africa such as Sapele and Iroko. As such, it is difficult for importers to provide information on “standard prices” since these vary widely depending on numerous factors, including the size of the customers’ orders, long-term supplier-customer relationships, customers’ widely varying requirements for additional sorts, machining, drying or other services, and the importers’ existing stock holdings.⁴

There is considerable interest throughout the UK timber trade in sourcing and marketing verified legal and sustainable timber. The large DIY chain *B&Q* currently imports non-certified teak wood from Indonesia, although they are striving for certification. Their parent company, *Kingfisher*, is committed to Social Responsibility. FSC certified, tropical hardwood products from Brazil are becoming available. At least one large UK importer carries stocks of a variety of lesser-known FSC certified Brazilian hardwoods, and is working on developing markets. Interviewees emphasised the key role that may be played by African suppliers in the future development of markets for certified/verified tropical hardwoods including Sapele and African redwood. Price premiums for verified or certified hardwood sawn lumber—which vary between 0% for some European hardwoods to over 30% for some Brazilian hardwoods. Significant issues associated with sourcing verified/certified wood products in the UK include commercial availability and lead times.

From the responsible harvesting of timber, to the sawmill, wood processor or importer; and then to the distributor, merchant or retail store; or to the manufacturer or joiner and ultimately to the final user, the timber supply chain (including forestry) comprises a vast number of operations, which has been valued by the Office of National Statistics (ONS) at over £7.6 billion (TTF, 2005).

The great variety of uses, and the diversity of operations involved in producing wood products and getting them to market, provides one

⁴ Some typical prices of wood originating in Ecuador are \$80-250 per m³ depending on species.

of the most wide-ranging and complex supply chains of any industry. For this reason, an exhaustive survey of possible outlets for *Prosopis* products is beyond the scope of this study, and only a broad cross-section of the industry has been surveyed in order to cover a range of possible markets. Although wood products also include panel products such as particleboards, oriented strand board, plywood, medium density fibreboard and other fibreboards, such as hardboard and softboard, this discussion largely considers the higher value sawn timber section of the industry.

□) **Potential UK markets for *Prosopis* products**

Interviews with a range of specialists in the UK timber and health food industry revealed the potential for *Prosopis* products to be marketed in the UK. The following discussion highlights the most important aspects of the wood for different end-users, including their main requirements from the wood or pod flour. This information is drawn from the perspective and opinions of the interviewees.

Wood Turning – *Crafts Supplies, ISCA Hardwoods*

Prosopis has a relatively high proportion of sapwood that is generally discarded for most applications. Chainsaw milling recovery rates (sawn timber to log volume ratio) is up to 20% lower with *Prosopis* than with other woods. Although this is a disadvantage for many applications, the presence and distinctiveness of the sapwood may be an advantage for wood turners who prize the variation in colour. Similarly *Prosopis* wood from Kenya has highly variable grains – some pieces with very large knots and some with two metres knot-free, although burls are rare – and this also signals that the wood may be valued by wood turners.

Crafts Supplies is a company dedicated to supplying wood turners. They use about 140 different hardwoods. None of these are FSC certified since they do not have enough space to store the FSC wood separately, and because their customers do not demand certified products. Generally, *Crafts Supplies* sources wood directly through agreements with community groups, but they also go through a limited number of agents.

ISCA Hardwoods, a joint venture between a tree surgeon and a furniture designer, stocks a diverse range of air- and kiln-dried hardwoods for sale to a large customer base of carvers, turners and other users. They stock a wide range of woods in small quantities for specialist end-uses. This type of operation would appear to suit the needs of a Kenyan *Prosopis* marketing initiative, especially in the pilot phase, because small amounts could be purchased by users who are experimenting with different types of wood. They are also interested in branch wood, and this may be an advantage for marketing the shrubbier *Prosopis* specimens that have not been pruned.

Furniture Making – *Philip Koomen*

Those characteristics that make *Prosopis* good for furniture making are its good decorative qualities, pleasant lustre or patina, good differential movement qualities and density (heavier than

mahogany). Furniture makers are interested in the wood's ability to sheen, in its use for handiwork, and in the grain and veneer. Good working characteristics include durability and processing quality. Durability includes the wood's susceptibility to infestation by pests such as pinhole borers and woodworm. The quality of the end-grain (cross-section of sawn timber) is important. The desirability of fissures is complicated, with some furniture-makers avoiding them and others seeking out interesting curls and burls in the wood. Curled and burred grains are especially valued by mahogany users and reproduction furniture makers. Similarly, forked branches can be appealing for furniture-users.

According to fine furniture-maker, Philip Koomen, *Prosopis* would make a good substitute for mahogany, Iroko, teak and oak. Although bland, mahogany is used in replication furniture; Iroko and oak are popular for joinery, and teak for boat decking. Certain Timber Trade Federation members specialise in African mahogany products and therefore may be interested in substituting with *Prosopis* (refer to TTF, 2006b). A similar African wood called Bubinga sells for £30 per foot³ approximately. However, furniture may be a difficult market to break into because it depends on taste.

Instrument Making – Paul Fischer Guitars

The way in which *Prosopis* shrinks equally in all directions and is therefore stable and warp resistant makes it particularly suitable for the manufacture of musical instruments.

Handicrafts – Pula, Good Woods

Pula is a specialist retailer that sells "gifts with a conscience". They work directly with producer groups and co-operatives of carvers in Nairobi, and sell many handicrafts, including wooden carvings, in their small shop on North Parade Avenue, Oxford. The owner, Dr. Phil Bacon, also distributes to other retailers in the UK.

The shop deals with small quantities and, for rapidity, transports items mainly by airfreight. If they amassed more than a half tonne then it would be possible to use sea freight. *Pula's* main requirements from the supply chain include knowing the people that they are working with, selling nothing that appears on the CITES list and ensuring that the products are environmentally benign. Owing to CITES and to recent animal rights activism, they are nervous about selling anything containing animal products in their shop.

Bacon believes that there is a market for such goods in the UK and would be prepared to buy *Prosopis* carvings from Kenya. The wood itself is said to look somewhat similar to *Pterocarpus angolensis* which is also dual colour and is used by East African carvers, but is

now on the Convention on International Trade in Endangered Species (CITES) list because it has been overused. The two distinct colours of the sapwood and the heartwood may be an aesthetic advantage for carving. Possible items that could be carved using *Prosopis* include salad servers, bowls, animal carvings, masks, small photo frames and small scoops. Prices for the preceding items in the shop are salad bowls - £32-65, masks - £9.25, small photo frames - £15.75, small scoops - 3.75, sitting animals - £9.25. There is a possibility for Pula to collaborate with HDRA and KEFRI on developing various product ideas and also forming partnerships with various local groups of producers and carvers.

Good Woods Project. A useful model for marketing *Prosopis* as handicrafts is the 'Good Woods' project run by WWF-EARPO. A presentation given by Severinus Jembe of the Crafts Producers Association at the 2006 'Small enterprise development and forests' meeting, run by IIED, described the basic features of the project (see Box 1 below).

Box 1. Case Study of Good Woods Project.

The Good Woods Project in Kenya

- Farm-grown timber supplying wood carvers associations in Kenya.
- Around 3,000 wood carvers involved in the project.
- The challenge:
 - over-exploitation of hardwoods and degradation of forests,
 - reduction of raw materials,
 - degraded forest habitats,
 - loss of biodiversity,
 - all leading to loss of jobs for carvers.
- Certification of neem and mango products.
- Pilot basis, with aim to scale-up to other East African coastal forests (e.g. with Mwenge Wood Carvers Association in Tanzania).
- Establishing a traceability process from source to end user.
- Value chain: forest owner→logger→transporter→logs buyer→processor→showroom→buyer.
- The process includes sawing, storing and curing, first crude carving, kilning and then second carving of wood.
- Three certificates obtained: 1) Forest management (for 10-30 farmers groups and a total of 600 certified farmers organised into the Coast Farm Forestry Association; 2) Chain of Custody (for co-operative marketing agency the Kenya Coast Tree Products); 3) Fair trade in collaboration with Traidcraft.
- Challenges include: the complexities of resource ownership, utilisation rights and attitudes, resource data, and costs of certification (around £7,000).
- Current markets: BESMO in the UK, Mennonite communities in the USA.

(Contact: Severinus Jembe, Crafts Producers Association, mzjembe@yahoo.co.uk, Peter Milimo, WWF-EARPO pbmilimo@yahoo.co.uk)

Severinus Jembe considered *Prosopis* to have better carving qualities than the certified neem and mango wood currently in use, and therefore anticipated significant demand for *Prosopis* from Kenyan wood carvers. He also commented that the biggest challenge for Baringo district may be over land ownership, since the currently communal land users/inhabitants may be disinterested in obtaining private land titles which may be required in order to be certified (although it may be possible to certify as wild products).

Flooring and Veneers – *Timbmet, Ecotimber*

Timbmet Silverman is one of the UK's largest importers of hardwoods. They import and process products into plywood, flooring, furniture and especially laminated wood and bespoke doors. They work with sawn and kilned lumber and provide a guarantee to customers about generic and bespoke traceable FSC, Chain of Custody (COC) and Verified Progress.

Timbmet requires relatively large volumes, usually tens of thousands of cubic metres. For the external joinery market and decking, about 1000 m³ (equivalent to about 2000 m³ of log) would be needed. Flooring requires pieces of 25 mm x 150 mm. The purchase price of flooring is £15-40 per m³, and the sale price £30-50 per m³.

As engineered wood, *Prosopis* would give solidity to other woods such as external decking, windows and doors. Long pieces could be used for doorsets, doorstyles or door lines since the wood burns slowly and is therefore good protection against the spread of house fires. One option would be to set up a floor manufacturing line in country, in order to produce engineered flooring. Parquet flooring would require a kiln, and for window components, a moulder and possibly a laminator. Alternatively, the flooring could be processed in the UK into either engineered or solid floor.

Ecotimber Ltd. is a marketing business involved in projects linked with government and public authorities. They use mainly Brazilian FSC timber imported through the Netherlands. For laminate, composite and engineered flooring and exterior decking, large volumes are needed. Another important factor for flooring manufacturers, particularly parquet floors, is the age of the tree since young trees tend to be of lower quality and are chemically and structurally different from more mature stands. In contrast to *Timbmet*, a representative from *Ecotimber* stated that for the flooring industry, FSC certification was not important.

Due to its exceptional hardness and resistance to wear, half an inch thick *Prosopis* was considered more than adequate for commercial

flooring material. Since *Prosopis* is very dimensionally stable with almost no tendency to warp, there would be no technical reason against end-matching tongue-and-groove flooring, although it would be necessary to keep the floor "tight" while it is being laid.⁵

Although it requires high capital investment, there is high added value from veneering⁶. About forty 0.6 mm leaves can be derived from one log, and veneered logs may be five to ten times the price of ordinary logs. Engineered pieces are sold for between £15 and £70 per m³. Sawn veneers of *Prosopis* hardwood could be made into geometric bandings and would add strength to the end product, for instance as an ebony or mahogany substitute. A possible end product could be swivel tray boxes with *Prosopis*-laminated side components 0.5 – 1.5 mm thick which are made using a bench press.⁷

In addition to the product and supply chain requirements of specialist end users outlined above, other important considerations for any timber buyers include:

- availability – stock, likely rate of production, volumes
- average log size
- growth rate
- presence of mineral streaks in representative range of samples
- grade of wood durability
- treatment of any samples e.g. stained / oiled / polished
- proportion of timber which is sapwood
- processing capacity and quality e.g. saw mill, kiln, other equipment, scale of industry
- legality of the timber extraction
- gender sensitivity of project and land ownership system in Baringo

It was also suggested that the major factors in marketing of *Prosopis*, besides availability and price, were the average clear dimensions and figure of the wood. At the same time, Hubert Kwisthout of *Ecotimber*, an ecological timber company involved in the import and marketing of a range of new species from mainly

⁵ The crooked *Prosopis* branches create most interesting grain and figure patterns that are associated with curved cracks and star checks (Felker & Anderson, 1994).

⁶ Another company, specialising in an extensive range of exotic species for decorative veneers, is *Reif & Son Ltd.*

⁷ The secret to the production of *Prosopis* veneer as well as the eventual manufacture of goods from that veneer is said to be special handling (Felker & Anderson, 1994).

community projects, commented that: "Invariably, the issue is not in the first place the quality of the timber but the producers' ability to provide a regular supply of material of consistent quality at a reasonable price. This requires a good organisation supported by adequate expertise".

Pod flour – Community Foods Ltd

Community Foods Ltd. is a health food business with expertise in the procurement, sale and marketing of organic and conventional dried fruit, nuts, seeds, pulses, grains and branded health foods. Their Marketing Manager expressed interest in buying organically-certified, dried *Prosopis* pods from community groups in Kenya, a few tonnes at a time. This would be an obvious starting point, with the possibility for developing a professional milling operation in Kenya over the longer term.

Community Foods' main requirements concern consistency and conformity. Suppliers need to complete a self-audit questionnaire which covers production and processing standards. Since the company is relatively 'time-poor', they are more likely to work with producers that can supply products in an appropriate format and packaging. It is important that there is traceability and that each batch of pods is controlled. *Community Foods* has had a great deal of experience in promoting small-scale enterprises from southern countries, and is not deterred by the low-tech nature of operations.

In order to market *Prosopis* food products in the UK it would be necessary to obtain clearance from the UK Food Standards Agency on 'novel foods' status, which would entail proving that *Prosopis* is used for human consumption elsewhere in the world but not in Europe. 'Novel foods' are foods or food ingredients that do not have a significant history of consumption in the European Union before 1997. The EC Novel Foods Regulation (EC 258/97) introduced a pre-market approval system for such foods (including GM), and the Food Standards Agency is the UK Competent Authority for this Regulation. Its role is to ensure that all novel foods approved undergo a rigorous safety evaluation that is scientifically valid. Novel foods have the potential to provide consumers with a more varied and nutritious diet and to provide producers and processors with opportunities to diversify into new markets.⁸ However, the Agency charges £4,000 to cover administrative costs.

⁸ It is Government policy to ensure that any novel foods on sale in the UK market receive a rigorous safety evaluation, which is scientifically valid (UK Food Standards Agency, 2006).

Over the course of this study, several potential international markets for *Prosopis* products have also come to light. These have been summarised in Appendix E.

6) Marketing considerations

Value chains

Value chain analysis helps to match supply and demand, and to establish an efficient marketing channel. A value / supply / marketing chain describes 'the range of activities required to bring a product from the producer to the consumer, emphasising the value that is realised and how it is communicated' (Schreckenburg *et al.*, 2006). Value stream mapping, for example, shows for each stage in the process, lead times, frequency, seasonality, quantity of products, cost, and kilometres, with a summary of production lead time, transport lead time, value added time and cost (see Straatmann *et al.*, 2006 for an example).

With regards to timber, much value is gained through postharvest activities in the supply chain compared to the price of the primary raw material: logs. For example, for the furniture maker *Philip Koomen*, the cost of raw materials comprises only about 10% of the product. If a rapid return is required, postharvest processing holds more potential for value-adding than certification, given the time necessary for conversion.

Scale of operation

When designing a marketing strategy for *Prosopis* that brings livelihood benefits to producers, it is important to consider carefully the enterprise scale and type, in terms of markets, products, and social organisation. Large-scale enterprises are common in logging; medium-scale in down-stream processing; and small-scale for chainsaw milling and portable sawmilling.

At the smaller-scale end of the spectrum, carving enterprises have comparative advantages because there are no diseconomies of scale and no alternative ways of making the products. Therefore they are an appropriate and sustainable alternative for Small and Medium-scale Enterprises (SMEs). Investment in wood working in Kenya may be effective in supporting employment, since jobs in woodworking have been growing at 31% per year, and currently 55% of jobs in the forestry sector are in wood working. Expansion of existing low-cost-technology enterprises can lead to incremental increases and healthy competition with manufactured products.

Furniture-making, on the other hand, may be better suited to larger operations which are able to better compete through economic economy of scale.

Branding strategy

For the purposes of publicity and branding for an international market, the name given to *Prosopis* products is important. Preliminary investigations suggest that '*Prosopis*' is difficult for people to remember and not particularly 'catchy', and the Kenyan name for the tree, 'mathenge', faces similar constraints.

One suggestion is to use 'mesquite' throughout any marketing strategy. The origin of this word is the Aztec 'mezquite' which means 'good wood' and this may also be useful for promotion of the products.⁹ In Europe and the USA, this word is already recognised to some extent, through historical films set in southern USA and Mexico, and through the small number of mesquite-flavoured food products already on the market. This would not be the first word of Aztec origin in the English language, others being chocolate from 'chocolatl'. It may also be more accurate to use 'mesquite' since the project concerns species of the series 'Chilenses', which botanically are generally called mesquites or algarobos. Whereas '*Prosopis*' may imply inclusion of the screwbeans or tamarugos, and Asian khejris which are all very different. The origin can also be differentiated with reference to 'Kenyan mesquite' (N. Pasiiecznik 2006, pers. comm., 22 September).

Several interviewees mentioned the importance of origin, and for this reason it is suggested to emphasise the provenance of *Prosopis* products. For the specialised market in particular, the emphasis should be on provenance since there is an element of connoisseurship in the buying process, whereas for the mass market it is important to ensure continuity of supply.

Relationships with buyers

It is important that growers develop close relationships with buyers of certified products, in order that they understand market and end-consumer needs. This points to the need for good communication, long-term commitment from buyers, prices that reflect social and environmental values, and favourable purchasing conditions which recognise disadvantaged producers and give them access to credit. Special relationships with sympathetic overseas buyers need to be developed, and project staff need to encourage the market to value community products.

Promising potential buyers in the UK are those with sustainable procurement policies for products, using, for example, the Code for Sustainable Homes - a five-star points rating for certified products,

⁹ Although the word '*Prosopis*' has similarly positive connotations since it is derived from the Greek '*pros*' meaning 'toward' and '*opis*', the Greek Goddess of abundance, i.e. 'toward abundance'.

or regulations on building construction. Such buyers include large schools, the Thames Gateway development, Welsh coastal defences, and the sustainable Olympics development. Product certification and value chain development needs to consider possible future regulations at the buyers end of the market, relating to carbon neutral policies and others which impact climate change and water usage. These may affect transportation options and the extent of forest regeneration in any export initiative.

Support for independence

Many SMEs need continuous, organised support to survive, in the form of business support, market development and brokering, and assessment and monitoring for both central market representatives and producer members.

Whilst support is needed for SMEs, it is necessary to bear in mind the detrimental impact of a 'deadly embrace' whereby NGOs and INGOs obstruct true capacity building and independence of the target group, and where the initiative folds when the support group departs. Therefore, it is important for support to be aimed at maximum organisation and financial independence at all levels, which may include facilitating a process of Participatory Market Development (PMD).

Development of associations

In order to improve income generation and community capabilities there is a need for stakeholders to organise into associations, develop a forest management plan, improve contacts with consumers, diversify NTPF harvesting, and develop a low-tech process for value adding inside the community (Straatmann, 2006).

Improved market access generally requires organisation into associations rather than individual efforts. Associations enable improved vertical integration and new opportunities, reduced transaction costs, and allow SMEs to appear on policy radar screens. The importance of strong associations is illustrated in Uganda, where there are approximately 3,000 forest-based associations and organisations (FBOs), and this high number gives SMEs lobbying power. For example, the Uganda Wood Farmers' Association is able to collectively sue the Ugandan Investment Authority over the building of an industrial park on prime forest. As with all associations, there are inherent risks and also tactics for building strong associations, which require awareness of and implementation.

For producer associations to access the market requires specific conditions, including the absence of industrial competition (e.g. in

the case of handicrafts), and avoidance of significant diseconomies of small-scale (e.g. in the case of wood-working) and of activities that can more efficiently be contracted out to small producers (e.g. outgrower arrangements) (Arnold, 2006).

Infrastructure and policy

New activities depend on adequate transport and education infrastructure which themselves require prior investment. Therefore infrastructure development (either by direct support or advocacy actions) is important to the success of any sustainable forestry project. In terms of policy, existing regulations and governance can discriminate against SMEs and these also need addressing for long-term sustainability.

Certification

In terms of certification, buyers have highly variable needs. Some source only certified timber, and others source no certified timber. An example of the latter is *Craft Supplies* (for wood turners), which was limited by lack of storage space to separate certified from non-certified, as well as lack of demand. Although some of the goods sold in the African handicrafts shop, *Pula*, were from FSC accredited producers, the majority were not because of the desire to avoid additional paperwork. Similarly *Philip Koomen*, furniture maker, avoided certified products because of their costliness and of the complicated Chain of Custody procedures and administration which did not justify the efforts put in by forest managers on the supply side.

Depending on the application, it may not be necessary to pursue formal fair trade certification. The approach of *Pula*, the African crafts shop, may be instructive since they use different parts of fair trade accreditation systems including general criteria and indicators, and visit the projects personally in order to monitor production and check the conditions under which items are produced, as well as subscribing to International Labour Organisation (ILO) standards. Since most timbers are now FSC certified, an alternative system is required to differentiate the product, and fair trade may be suitable in this respect.

Nevertheless, certification may be perceived as an additional burden for producers. It can place heavy burdens on small to medium sized forest enterprises and therefore its appropriateness needs to be evaluated in relation to the supply group. Less than 1% of total community forest operations are involved in certified trade. Main challenges of forest certification, eco-labelling and social auditing for small forest enterprises include: costs (of conversion and charges), appropriateness of standards, access to information and

support, relevancy, and certification models being culturally alien. It is often set up for larger operations, and is only relevant for those who have got secure land tenure and access to resources. In addition, the forest certification system has been designed specifically with timber in mind and therefore Non-Timber Forest Products (NTFPs) are sidelined.

On the other hand, there are plenty of benefits to be accrued from certification, including access to subsidies, reduced regulation, increased efficiency, market access and premium prices of about 20% at the market end of the chain (although not common at the producer end). In addition, FSC standards, certification processes, labelling and tracing have a strong social element.

When designing a certification system it is therefore necessary to carefully consider the legality of forestry, security of land tenure, indigenous / worker rights, management, planning and monitoring. It may be useful to develop a three-step model of producer involvement: i) community-based fair trade, ii) pre-certified and iii) FSC certified. Alternatively, a socio-participative modular approach to certification, similar to the Participatory Guarantee System of local organic certification, focuses first on local, then national and finally expands to international markets. Overall, discussion of certification options should include producers as well as project facilitators and market-end stakeholders.

7) Conclusions

This study has identified a number of potential market niches for *Prosopis* products in the UK, including handicrafts, craft supplies (e.g. for wood turning), furniture-making, instrument-making, flooring and veneers, and *Prosopis* pods, either whole or ground, for the health market. It has also initiated compilation of the key requirements of potential end-users and considerations for different applications.

Promising markets exist for the pod flour, although the quickest and easiest export business would probably be for hardwood. As the Timber Trade Federation point out: 'The multiplicity of uses and value provided by wood products cannot be matched by any other raw material' (TTF, 2005). In addition, *Prosopis* wood displays the beauty of grain sought after by connoisseurs and woodworkers who produce distinctive cabinetry, furniture, crafts and flooring. Since the timber industry is said to be very susceptible to fashion cycles, the most sustainable approach may be to create a new market.

One of the key recommendations of the study is that the commercialisation of *Prosopis* should start with a solid domestic marketing base and only then expand to regional, continental and international markets. Furthermore, whilst UK markets have been the focus of this discussion, opportunities for inter-African, Africa-Asia trade, along with trading relationships with other European and American countries should not be discounted. Since *Prosopis* is widely known in the USA (as mesquite) it may be worth focusing on these established markets, with a particular bias towards those with FSC and organic interests.

The success of any marketing drive lies beyond identification of suitable end-uses and markets. The entire project needs to balance all aspects of sustainability – social, environmental and economic, not forgetting the so-called fourth pillar of sustainability, management. Furthermore, and when involving rural communities as suppliers or target beneficiaries, it is crucial to adapt business styles to local culture and societal values; producers' goals may not be profit maximisation as in Western-style business, but employment and service provision.

Other key aspects of successful commercialisation of *Prosopis* from Baringo and other regions of Kenya where forestry is based on communal forest resources, are systems of governance and regulation.

Next steps

This study represents only the beginning of an evaluation of the potential for *Prosopis* marketing in the UK. Individual contacts need to be established within a wider range of businesses, and the database that has been compiled constitutes a starting point for further enquiries and interviews. The database may be supplemented as other potential markets come to light, such as the *Body Shop* which uses certified wood in their products. Individual companies which have expressed an interest in seeing the larger wood samples include *ISCA hardwoods*, *Clarks Wood Company Ltd.*, *Ecotimber Ltd.*, *Philip Koomen* and *Timbmet*.

After a wider range of companies have been contacted, a SWOT analysis may compare the relative strengths and weaknesses of each market. This would involve an economic breakdown of costs and value chain analysis. Participatory Market Development (PMD) with stakeholders can be used to prioritise the most appropriate products and markets.

It is essential that further marketing efforts are founded on adequate knowledge of the quantity and quality supply of Kenyan mesquite that can be reliably offered.

In terms of developing certified *Prosopis* products, established contacts with FSC Africa and Wood Mark (Soil Association) should be followed up. For fair trade, collaboration with Traidcraft, the International Fair Trade Association and COFTA in Nairobi is recommended (R. Donnelly 2006, pers. comm., 26 September).

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N.B. HDRA holds database of contact details of all personal communications quoted.

Appendix A: Interview Guide

Company	Organisation
Type of business * Importer / merchant origin / buyers of products now traded * Manufacturer current sources of timber / types of products * Retailer origin of products now traded / consumer demand * Other	Aims Activities Regions
Contact person	Contact person
Position	Position
Interest in using a novel hardwood	Information on market access for Kenyan products
Possible uses	Facilitation roles
Requirements from wood Hardness Durability Grain Quantities level of processing other	Advice on promising outlets for FSC / organic / ethically-traded hardwoods in the UK
Requirements from supply chain size / amounts location time of delivery frequency communication reliability	How to facilitate contact of Kenyan community with organic and fair trade buyers? Generate income from invasive species
How much might they pay? (price of similar products)	Future collaboration / partnerships
Others interested?	
Future demand – more trees not being planted at the moment, takes 15 yrs from seed to timber	

Appendix B: Information Brief - Marketing *Prosopis* Wood in the UK

Project Background

With support from Kennington Overseas Aid (KOA), the Henry Doubleday Research Association (HDRA) is working with the Kenyan Forestry Research Institute (KEFRI) on commercialisation of sustainable *Prosopis* products. Whereas eradication of this invasive tree species is expensive, and almost impossible, in fact the tree has multiple uses that are well known in its region of origin - South America - but not yet known in Africa.

Prosopis trees, known as mesquite in North America and algarrobo in South America, grow in marginal areas where people have little else to make an income from. The timber is very hard and stable, making it ideal for furniture and flooring applications, it makes excellent charcoal and construction poles, and flour from the pods can be used to substitute wheat or maize flour by 10-20%. With the correct knowledge and management, it is also one of few 'pioneer' species that can be used to colonise desert land as the first in a managed succession of reclamation.

Why buy *Prosopis* wood?

It is one of the hardest and most stable woods known, much harder than teak or oak, with a beautiful reddish colour and grain reminiscent of rosewoods. However, it comes at only a fraction of the cost, economically and environmentally. Appropriate technology may now be applied so that the short and often crooked logs can be viably converted to sawn timber. Many thousands of cubic metres are processed annually in the Americas with ready markets for furniture and flooring, though Europeans have yet to be exposed to this exceptional and sustainable tropical timber.

Summary of Wood Properties

Colour	Golden brown – dark reddish orange heartwood
Grain	Distinctive, straight or swirling, usually asymmetrical, with ingrown bark and mineral streaks
Log size	Usually 1.5-2.5 m long and 25-50 cm in diameter
Density (dry)	710-910 kg / m ³
Tensile strength	High
Hardness	2345 Janka (1.75 times that of teak)
Volumetric shrinkage	4.7%
Tangential shrinkage	2.2%
Radial shrinkage	2.6%
Durability	Heartwood exceptionally long-lasting, termite-resistant and resilient to extreme weight and radical moisture changes.
Specific gravity	0.6-1.1
Moisture content	11-12% (dry)
Finish	High natural patina when polished
Workability	Sawing: Very good, Nailing: good, splits easily, Sanding: good with end grain requiring #16 grit paper to cut properly, Finishing: No known problems
Ideal uses	Distinctive cabinetry, furniture, parquet flooring and crafts

Will buying *Prosopis* products help or harm the environment? *Prosopis* trees are widespread, and not at all rare. Using the wood will help preserve tropical rainforests by taking the pressure off them as a source of timber, and using the wood and pods will help protect ecosystems threatened by invasion and restore those already invaded.

Who will benefit? It is strongly hoped that the very poor who live where *Prosopis* trees grow best will be able to take advantage of this 'free' resource, and can undertake, with little investment, collection and primary processing of logs and pods. This can supply an export market as well as supporting local needs as a famine food and fuel wood, and possibly a family food and furniture wood.

A Selection of *Prosopis* (Mesquite) Wood Products



Prosopis jewellery box
Made by Jim Lee (photo credit Peter Felker)



Unstained plain sawn *Prosopis* flooring produced by the Kenya Forestry Research Institute (KEFRI) (Photo credit Peter Felker)



Prosopis cabinet produced by the Kenya Forestry Research Institute (KEFRI) (Photo credit Peter Felker)

Prosopis end grain flooring is in high demand in Texas. Above is tung oil finish and below is water based flooring finish.



Appendix C: Information Brief - *Prosopis* Pod Flour

Introducing *Prosopis* pod flour to the UK, a healthy food product that can be used as a baking ingredient or a seasoning in food and drinks, adding flavour and improving nutritional value.

Prosopis pods have sustained desert dwellers in the Americas for centuries:

- With a low glycemic index¹⁰;
- A valuable source of calcium, magnesium, potassium, iron, and zinc;
- Adds vegetable protein including lysine and other amino acids to the diet;
- Can be used as a tasty condiment or in baking.

***Prosopis*: Supporting communities in African arid lands**

Prosopis trees, known as mesquite in North America and algarrobo in South America, grow in marginal areas. With support from Kennington Overseas Aid (KOA), the Henry Doubleday Research Association (HDRA) is working with the Kenyan Forestry Research Institute (KEFRI) on commercialisation of *Prosopis* products. This will support marginal communities in Kenya to generate an income using this hardy, drought-resistant 'tree of the poor'. Facilitating these communities to add value to and manage these local trees has dual impacts of reducing degradation of arid lands and increasing local living standards. It is intended that all *Prosopis* products originating from this region will be certified to ensure environmental sustainability and social equity.

***Prosopis* pods: A traditional food**

Prosopis pods have traditionally been used as food in their native Americas. Archaeological finds indicate that they were eaten in the Teotihuacán Valley in Mexico at least 5,000 years ago, and formed an important part of the diet for many Amerindians from present day Argentina to Arizona. *Prosopis* pod flour has a sweet, smoky flavour which is a valued part of the culinary traditions of the Pima, Tohono O'odham, Seri, Apache, Cocopah and Maricopa amongst others, and now the Slow Food Movement in the USA has also taken up the cause of protecting this traditional food. *Prosopis* pod flour is commercialised in the USA, marketed by several retailers such as Casa de Fruta, Ruby Range and Smokeys SW Harvest, and many processed products are available in South American markets. The first Europeans also saw its value, which is why they took it to their other colonies, though there, its use as a food and timber has not taken off – yet.

Why buy *Prosopis* pod flour? The nutritional levels supplied by *Prosopis* pods are extremely high. They are high in carbohydrates, dietary fibre, sugar and amino acids such as lysine, and thus are a rich food source for humans and animals. Low in fat and cholesterol, *Prosopis* flour is gluten-free and an excellent source of calcium, magnesium, potassium, iron, and zinc.

What are the health properties of *Prosopis* pod flour?

Medical studies on *Prosopis* pod flour suggest that it is extremely effective in controlling blood sugar levels in people with diabetes. The natural sweetness in the pods comes from fructose that the body can process without insulin. In



¹⁰ There is some controversy about the validity of the glycemic index, an issue that has been discussed in the American Journal of Clinical Nutrition (Peter Felker 2006, pers. comm., 12 October).

addition, galactomannin gum in the seeds and pods slows absorption of nutrients, resulting in a flattened blood sugar curve, unlike the peaks that follow consumption of wheat flour, corn meal and other common staples.

With a glycemic index of 25 and high levels of dietary fibre, *Prosopis* flour requires a longer time to digest than many grains, e.g. 4 to 6 hours compared to 1 to 2 hours for wheat. These factors result in a food that sustains constant blood sugar over time and so prevents hunger. So here is a food that is reported to both support the diabetic's diet and also help maintain a healthy insulin system for everyone.

Component in <i>Prosopis</i> flour	Value
Crude protein %	8.94 (Good)
Digestibility (in vitro) %	70 (Good)
Metabolisable energy MJ/kg	10.2 (Good)
Phosphorus %	0.1 (Slightly low)
Sulphur %	0.14 (Good)
Potassium %	1.2 (Good)
Sodium %	0.12 (Average)
Calcium %	0.47 (Average)
Magnesium %	0.12 (Average)
Copper ppm	3 (Slightly low)
Zinc ppm	15 (Slightly low)
Manganese ppm	12 (Low)
Iron ppm	130 (Good)

Amount Per Serving (15 g):	
Calories	30kcal
Total Carbohydrates	6g
Sugar	1g
Sodium	0mg
Calories from Fat	2kcal
Dietary Fibre	3g
Protein	1g

Taste and uses

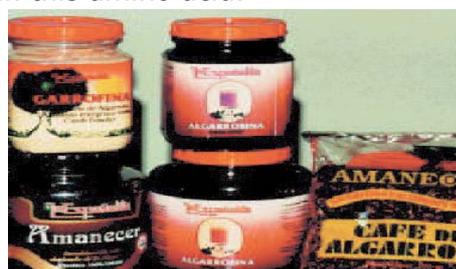
Prosopis flour has a unique taste that has been variously described as sweet or slightly nutty with a pleasant hint of molasses, caramel or cinnamon, or with a sweet chocolate or coffee flavour.

This fragrant flour can be used either in baking or as a spice/seasoning in food and drinks. As flour, it is generally used in combination with other flours, substituting about 10-30% *Prosopis* pod flour, as above 25% the taste becomes too strong for most palates. It is widely acclaimed as a delicious addition to pancakes, muffins, cakes, pastry and biscuits. Two tablespoons can be added per 16 tablespoons (8 fl.oz, 240 ml, 1 cup) of ingredients for an appetising flavour and aroma in all baked goods.

As a spice, it can be sprinkled on food that is then grilled, fried or boiled. It can also be used for breading meat and fish and is a good flavouring for many dishes. It helps to 'liven up' recipes and can be added to soups, stir-fries, vegetables, scrambled eggs, gravies, puddings, ice cream and just about anything. As a flour substitute and condiment, its versatility is seemingly limitless, amounts adjusted to personal taste.

Some add it to their breakfast smoothies and find they don't get hungry mid morning. Anyone who uses a meal replacement drink and finds that they are hungry long before lunchtime will appreciate *Prosopis* flour. Adding a tablespoon to a drink will help stave off hunger for about 4 to 6 hours. *Prosopis* pod flour is also a tasty and nutritious addition to gluten-free flour mixes and as an ingredient to balance vegetarian diets, since its high lysine content makes it the perfect addition to other grains that are unusually low in this amino acid.

A range of other foods and drinks produced from *Prosopis* pods, including syrups and coffee substitutes (Photo credit G Cruz).



Appendix D: Characteristics of value-added *Prosopis* wood products

PRODUCTION FACTOR	WOOD PRODUCTS								
	Firewood	Charcoal	Flooring	Artisanal products		Furniture components	Entire furniture manufacture		
Scale	-	-	-	National	International	-	Village level quality	National level quality	International level quality
Characteristics	Green and dried wood, < 12 cm diameter	Product that results from earthen pits or brick kilns.	http://www.w.birgerjuell.com/home.html	Carved & turned articles, small boxes with poor joinery & finish	Turned articles e.g. pens, perfume, holders, clocks with excellent finish and hardware.	Products such as parts for window shutters, chairs, kitchen cabinets.	Crude construction with nails & no joinery	Medium quality with some visible nails, some joinery, < 150 grit sanding, no design input. Wood not kiln dried	High quality, no visible nails, ex. quality glue joinery, >180 grit sanding, Wood kiln dried to < 11% moisture. Commercial quality, contract & custom furniture. Could be designed & specified.
Web examples				www.craftusa.com	www.craftusa.com				www.wildlifecollection.com www.houstonandcompany.com
Workers/unit	1-2	Family		2-3	2-3	2-3	1-3	2-15	6-10
Wood resource requirements /month	about 100 kg	15 m3 of wood							500-1000 bf/mo of veneers, 500 sf/mo panels, 30 pcs 4 x 8/mo
Product output/month	about 100 kg	1000 kg charcoal			800 pens/mo or 160 boxes/mo	4000 bd ft of components	One hundred chairs @ \$20		
Value of product to producer/month		\$30-50			\$8000	\$8000	\$2000		\$40,000 - \$60,000/mo
Equipment requirements	machete or axe	Shovel & Axe		Lathe, table saw, drill press, glue clamps	Lathe, table saw, bandsaw, planer, jointer, router, sander, drill press, glue clamps	Sawmill, table saw	Sawmill, table saw, belt sander	Sawmill, table saw, belt sander, glue clamps, drill press, shaper, paint brushes,	Saws, planers, sanders, glue clamps, drill press, shaper, jointers, routers, compressor, spray gun for finishing
Electricity required	No	No		Yes < 20 amp single phase	Yes < 20 amp single phase	Yes, 50-100 amp 3 phase	Yes, 50-100 amp 3 phase	Yes, 200 amp 3 phase	Yes, 200 amp 3 phase
Capital requirements	\$10	\$15			\$5500				\$85,000 equip. but no marketing, materials or storage

Data for artisanal products courtesy Bill Smith, Mastercraftsman, Lynden, Washington. For International quality furniture courtesy of Steve Ulrich, co-owner, Wildlife Collection, Kingsville, TX, USA. Table compiled by Peter Felker, 2006, with additions.

Appendix E: Examples of Potential International Markets for *Prosopis* products, at October 2006

America

Food company *Case de Fruta* (www.casadefruta.com) is interested to pay for organic certification and to contract the purchase of 2-20 tonnes of *P. pallida* mesocarp flour. Contact *Case de Fruta* for price information. Note that they would not purchase *juliflora* pods due to their reputedly bitter flavour.

The Chicago-based flooring company, *Birgir Juell* (<http://www.birgerjuell.com/>) is interested in buying substantial quantities of end-grain *Prosopis* flooring.

Asia

Several interviewees in this study suggested Asian companies as likely being interested to purchase *Prosopis* timber, although they may be less interested in certification, viewing the wood purely as a commodity and less as a sustainable product with positive livelihood effects.

Wood Mark is already working with the Asian market on the export of tannins from Tanzania, and there may be a possibility to link in with *Prosopis* tannin production from Kenya (G. Hellier 2006, pers. comm., 26 September).