

Support to
De-bushing
Project



Adding Value to Namibian Encroacher Bush



Turning the Challenge
of Bush Encroachment
into an Opportunity



Implemented by



Introducing the Support to De-Bushing Project

Namibia is affected by bush encroachment on a massive scale. The phenomenon currently affects some 26 to 30 million hectares of farmland in 9 of the country's 14 regions. That amounts to roughly 30 per cent of Namibia's land area. Bush encroachment has lowered the livestock capacity of rangeland by up to two thirds. It further results in severely reduced biodiversity and limits the recharge of groundwater.

Despite the negative impacts, **the encroacher bush has developed into a huge biomass resource**, estimated at about 200 to 300 million tonnes. Measures used to combat bush encroachment create positive opportunities for the Namibian economy, such as the use of the resource for electricity generation and value chain development in other sectors. De-bushing therefore offers the potential to increase agricultural productivity, economic growth, employment and energy security, without competing with food production.

In line with the Fourth National Development Plan (NDP4) and the National Rangeland Management Policy and Strategy of 2012, **the Support to De-bushing Project** aims to strengthen the restoration of productive rangeland in Namibia. It identifies value chain opportunities to trigger large-scale de-bushing activities. Its focus is closely aligned to the National Industrial Policy of 2012 and the Growth at Home Strategy, which promote domestic value addition for local resources. The project will foster institutional development in the biomass sector and provide support to improve the legal and regulatory framework for large-scale bush control.

The Support to De-bushing Project runs from 2014 until 2017 and is a bilateral cooperation between the **Namibian Ministry of Agriculture, Water and Forestry (MAWF)** and the **German Federal Ministry for Economic Cooperation and Development (BMZ)**. It is implemented by the **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH**.



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WHAT IS THIS BROCHURE ABOUT?

This brochure provides an overview of **biomass value added products that can be produced from encroacher bush in Namibia**. It is based on the study "Value Added End-Use Opportunities for Namibian Encroacher Bush (2015)" by Prof. Dr. R. Trede and Professor Dr. R. Patt of Development Consultants for Southern Africa (DECOSA) CC.



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Opportunities to Add Value to Namibian Encroacher Bush

Bush encroachment negatively affects a large number of farmers across Namibia. Bush control efforts in form of labour-based or mechanical bush thinning are cost intensive. The development of value chains and the marketing of biomass products by dedicated businesses are ways of recovering these costs for farmers.

The current economic utilisation of encroacher bush in Namibia focuses mainly on firewood for local communities, charcoal for exports, and small production of compressed firewood. However, numerous end-use opportunities can be identified. Some require large quantities of resources, others much smaller quantities but may still lead to considerable value addition as well as to the creation of small and medium enterprises (SMEs) and employment.

There is extensive, diverse demand for biomass on both domestic and international markets, with interest shown by, among others:

- the energy sector, whose especially large demand is sufficient to trigger large-scale bush clearance projects. Bush material can be used to substitute firewood in private households and fossil fuels such as coal or oil in industrial boilers and power plants;
- the agricultural sector, which can use biomass as feed for cattle or wild animals, or as fertiliser for crop production; and
- the construction industry, where biomass can be used to produce building materials, such as chipboards or wood panels.



PICTURES ON OPPOSITE PAGE

1 Chipping of bush with a mobile chipper using a labour intensive approach.

2 Briquettes are made by fine grinding of wood chips and compacting of the dry biomass.

3 The core machine is an extruder press. Through pressure and heat the lignin, cellulose and hemicelluloses form a natural binder.

A major asset of utilising encroacher bush commercially is the huge quantity available. Based on the assumed 26 to 30 million hectares and a harvest of 10 tonnes per hectare on average, encroacher bush theoretically offers 260 to 300 million tonnes of biomass. This opens an enormous potential for value added production.

Disadvantages of encroacher bush compared to other industrial wood resources include the mixture of hardwoods from different species with mechanical and chemical properties which vary to a high extent and the dimensions of the woody biomass which are fairly small (up to 20 cm diameter, normally up to 5 m long). The species are often very heavy hardwoods.

A major challenge for the processing of encroacher species is the lack of knowledge about properties of individual species, such as strength, grain, resin and other contents.

To date, the products produced on economic scale are compressed wood, charcoal and wood chips. Commercial experience on very small scale – as an additional income for communal and commercial farmers – is available regarding the marketing of fire wood and poles. Several people, mainly commercial farmers, produce on experimental scale bricks from wood and charcoal, wood-plastic composites, animal feed, mulch and compost. However, only the last two products are sporadically and informally marketed. In the Kavango and Zambezi Regions, timber and furniture were produced as well as carved products; however, on the basis of larger logs and not from encroacher bush. The same applies for most traditional medicine.

This brochure showcases potential products made from encroacher bush, considering international best practices and research as well as traditional uses and opportunities discussed in Namibia. It identifies challenges and opportunities and takes a closer look at the value chains.



Firewood

Firewood is mainly produced informally by the rural population for cooking and heating. It can be roughly estimated that 100 000 households are involved in firewood production. Firewood is sold by numerous informal producers in communal areas and by some commercial farmers.

The price of firewood varies considerable from N\$ 1,700 per tonne in Kavango to N\$ 3,000 per tonne in Katutura (based on informal retail prices). Thus firewood is as expensive as charcoal for exports.

Firewood has and will in future have a stable demand in Namibia. However, the current form of harvesting live wood, even in densely populated areas not affected by bush encroachment, will result not only in the depletion of scarce resources, it also further increases the prices which are currently already hardly affordable by main buyers of firewood, i.e. the poor segment of the population in informal urban settlements.

people in informal settlements can often only afford one meal per day



In order to avoid such developments and to contribute to combating bush encroachment, the firewood value chain should be formalised as much as possible through measures such as:

- Strengthen rural education programmes to avoid informal harvesting of scarce resources and protected species.
- Monitor illegal harvesting and enforce the law.
- Consider a harvesting ban for firewood in endangered areas but respect the rights of Traditional Authorities.
- Mobilise entrepreneurs to start formal firewood businesses based exclusively on encroacher bush; this will also contribute to avoid further price increases for end-users who have to purchase firewood.

Census data of 2011 shows that **46 per cent** of Namibian households use firewood for heating and **53 per cent** use it for cooking

Value Chain

In principle all species can be and are used as firewood, although heavy species like mopane are preferred. Preferably dead and thus dry wood is used as firewood in Namibia. It is mainly collected manually and cut into the required lengths (again manually), if necessary.

Only a small portion of the firewood derives from encroacher bush, mainly as by-product of de-bushing on commercial farms.

Most producers in communal areas sell firewood in smaller pieces along the main roads. Some commercial livestock farmers produce firewood as by-product with respective packaging.

Most of the firewood is also transported to the markets informally: end-consumers from urban areas buy it along the roads, truck drivers load the wood on their empty trucks from the north and transport it to the main markets in central Namibia and at the coast or farmers transport it with their own vehicles to the markets.



to cook one meal, about 2.5 kg of firewood are used

In informal settlements of urban centres, the firewood is mainly sold loose by pieces. Moreover, supermarkets and petrol stations in urban areas sell firewood in 10 kg bags.

Challenges

- Hardly any formal value chain
- Harvesting in environmentally sensitive areas and even of protected species
- Very limited employment creation
- Limited value addition and income generation for the producers
- High prices for end-consumers who have to purchase firewood
- Low energy efficiency

Opportunities

Firewood is used by lower income groups mainly for cooking and heating and by higher income groups for barbeque and heating at open fireplaces. The demand of firewood is, due to informal production and marketing, very difficult to estimate. A total demand of 550 000 tonnes per year is assumed to be a realistic minimum.

Although future demand may be reduced by rural electrification programmes, the effect will be minimal if not combined with higher income. Moreover, demand will increase with population growth and with the continuation of migration from rural areas to urban informal settlements.

- High acceptance as cooking and heating material
- Mixed species suitable
- Vast majority of producers from previously disadvantaged background
- Labour intensive; no skills required
- Very low investment
- No additional production inputs (e.g. water, electricity) required
- High local demand (ca. 550 000 t p.a.)
- High value addition if marketed in urban centres
- Theoretical potential to de-bush 55 000 ha p.a.

Currently the effects on de-bushing are negligible since most of the firewood is either dead wood or not harvested in areas affected by bush encroachment.

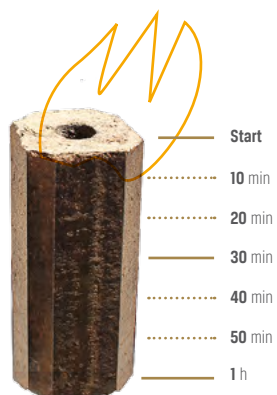


Compressed Firewood

This product is known internationally under a number of different names such as wood or biomass briquettes, biomass logs, extruded wood logs or heat logs. Namibian products are known as "Bushbloks".

Compressed firewood is mainly used for heating; industrial uses might be possible in the nearer future. Despite different production technologies, all products are made by fine grinding of wood chips and subsequent compacting of the dry untreated biomass. The aim of compressing is a higher bulk and energy density compared to biomass chips, so that transport costs can be reduced and the combustion behaviour can be improved.

briquettes have a much longer burning time than wood: up to one hour per block



Two Namibian companies are currently involved in the industrial production of compressed firewood. The Cheetah Conservation Fund (CCF) is harvesting encroacher bush as one

measure to ensure the survival of cheetahs and their ecosystem. Their Bushbloks are mainly marketed in South Africa and in smaller quantities on domestic markets in urban centres. Ecolog has established a more sophisticated plan with main focus on overseas exports. Mainly because of the ash content of 3 per cent, which does not comply with the European standards, they are still in an experimental stage.

Value Chain

Based on experience in Namibia, there seem to be no restrictions in the processing of specific species. Mixed encroacher bush has been processed successfully. Moreover, the heavy Namibian species have an advantage, vis-à-vis compressed firewood from other countries.

In a typical production process, the material is harvested manually or semi-mechanised. The wood is first dried and then fed into chippers. The chips are transported to the processing plant for fine grinding and sieving to eliminate wood of unsuitable sizes, sand etc. Thereafter the material is dried. The core machine is an extruder press. By the use of pressure and heat

the chips bond and are extruded as compacted product. The capacity of a plant is mainly determined by the extruder press. Technologies are known with capacities from 5 000 to 50 000 tonnes per annum output.

Challenges

Manufacturing of compressed firewood requires a full-time overall manager, who is also responsible for marketing, and a technician for operation and maintenance. Such professionals are important because of the limited technical experience with the production based on Namibian hardwoods.

Further challenges include:

- Serious technical problems with chippers (not adapted to Namibian species) and extruders (sand in raw material)
- Namibian end-products do not comply with all requirements for European private end-users (e.g. regarding ash content)
- Possible future larger operations create limited employment and require professionals (management, technical operation and marketing)
- Industrial use doubted by some experts and large-scale production for industrial end-users competing with wood chips and pellets
- Overseas exports only possible with customised logistics concept, still to be identified



Opportunities

The current small production demonstrates a demand of private end-users from higher income groups in Namibia and RSA, mainly for heating. This demand could be considerably increased: lower income groups in informal settlements could become customers.

The market of private consumers in Europe shows positive prospects. A constraint may be the quality requirements: most parameters are more than fulfilled by compressed wood from Namibia, but not all. Before starting attempts to penetrate this potentially huge market, detailed market research is required.

The industrial market in Namibia and overseas could be another option. It is remarkable that one of the largest energy producers in Europe signalled serious interest to import from Namibia. However, this could not be materialised due to the small existing capacities.

Positive properties include:

- Mixed species and wooden parts of the bush with small diameters suitable
- Good properties of the final product (among others, a bulk density of 450–500 kg/m³ and an energy density in the range of 5.2–7.4 GJ/m³; calorific value some 4 870 kcal, close to that of coal)
- International classification as "smokeless fuel"
- Clean to handle and relatively easy lighting
- Production also in small capacities possible

compressed wood is a relatively new product in Namibia that requires professional marketing

a combination with other products such as charcoal or poles is possible

Bushblok production of the Cheetah Conservation Fund in Otjiwarongo



Charcoal

Charcoal currently plays the most important role in using and processing wood from de-bushing in Namibia. It is exported and used for barbeque. Main countries of destination of Namibian exports are RSA and UK. For years, the markets for barbeque charcoal are under-supplied and there are indicators that the gap between demand and supply will further increase.

The current Namibian charcoal industry is characterised as follows: there are about 240 active producers and 6,000 people are directly and indirectly employed. The annual production is about 85,000 to 100,000 tonnes, of which 99 per cent is exported for barbeque. The main production area is around Grootfontein, Otjo, Otjiwarongo and Tsumeb. The local demand for charcoal is insignificant compared to Namibia's exports. Although the consumption seems to increase slightly, barbeque in Namibia is still dominated by firewood.

Namibia uses not more than 1,000 tonnes per year



Value Chain

Charcoal is produced from solid wood of different dimensions, preferably 10 to 20 cm in diameter. In principle, all wood species are suitable for charcoal production. Heavy hardwoods – as they are common in Namibia – result in the best charcoal for barbequing.

The wood is mainly harvested manually in communal areas and on commercial farms and is heated resulting in partial combustion. In Namibia, nearly all commercial producers use simple drum kilns made from steel sheets. After carbonisation and cooling, very big pieces of charcoal, non-carbonised wood and larger stones are separated manually and the remains are sieved. The charcoal is packed on the spot into 50kg bags. Very few Namibian producers are involved in retail packaging for the end consumer. Some larger trading companies do retail packaging for direct exports to overseas markets. However, 50 per cent of the charcoal is exported in 50kg bags to RSA.

Challenges

- Lack of control; partly illegal harvesting
- Lack of regulations, e.g. for combating bush encroachment, harvesting guidelines, etc.
- The wood harvesting permit system is partly not practical
- Limited capacity and productivity of the industry
- Due to extremely hard work, problems to mobilise workers
- Current working conditions often not satisfactory (e.g. housing, protective clothing)
- Namibia's strong position on export markets endangered by lack of business orientation and quality consciousness of the industry
- Long marketing chains (often via RSA)

Opportunities

Major strengths of Namibian charcoal production

- Mixed species suitable for high quality barbeque charcoal
- 50 per cent (by number) of producers from previously disadvantaged background
- Simple technologies provided by local SMEs
- Labour intensive production
- Low investment; no additional inputs (e.g. water, electricity) required
- World market increasingly undersupplied
- Strong position of Namibia (6th largest exporter worldwide, export about N\$200 million p.a.)
- Suitable legislative framework for conservation/environmental stability and sustainable utilisation in place

Considering the demand, the production of barbeque charcoal could be increased from currently about 100 000 to 400 000 tonnes in 10 years. This development requires urgent elimination of the existing challenges, in particular improvements of the regulatory framework and the limited productivity.

The current operation mainly based on manual harvesting and carbonisation with simple earth kilns is very labour intensive. The majority of the charcoal producers confirmed that they would increase production and thus employment immediately if they could find workers. It is assumed that at least 700 additional jobs are available. The certainly extremely hard work, in particular with regard to wood harvest, has been identified as main reason for the challenge to recruit workers. The production and export of charcoal could be increased fourfold, considering the demand and the resources from de-bushing. This development potential would result in employment for 21 000 people in the production (with semi-mechanised harvesting) and in addition 2 000 jobs in other businesses of the value chain.

The small charcoal (under 13mm) and the dust are normally dumped. It may be considered to carbonise wood with diameters under 5 cm and briquette the charcoal. Furthermore, producers should be encouraged to use the parts of the bush, which are not used for charcoal, for other products, such as compressed firewood, pellets or animal feed.



Heavy hardwoods – as they are common in Namibia – result in the best charcoal qualities for barbequing.

there is currently no industry representative body with a mandate to set standards

limited skills are required to produce charcoal



Wood Chips and Pellets

Bio-energy is of major interest for Namibia's de-bushing programmes. The already huge demand in industrialised countries can often not be satisfied due to limited resources. The Namibian Government is committed to explore the use of bio-energy to make the country less dependent on electricity from its neighbours and from imported fossil fuels.

Worldwide, there is an enormous demand for wood chips and pellets with imports of 35.1 million tonnes of chips and 12.2 million tonnes of pellets per annum. Both pellets and wood chips are suitable resources for heat and power generation— chips mainly for shorter and pellets for longer transport distances. In Europe, pellets are also used for domestic heating.

Compared with chips, pellets have the advantage of being a more homogenous product. Whilst for wood chips no quality standards are defined in Europe, they exist

for pellets, for example the European ENplus with three different categories. Namibian encroacher bush cannot even comply with the lowest category of ENplus with regard to ash content, chlorine and sulphur. Non-compliance will exclude a Namibian supplier from most of the European markets. Moreover, supply and demand of high quality (certified) biomass pellets are currently fairly balanced in Europe.

in 2014 the total demand of Ohorongo for chips was 85 000 t/year



Value Chain

Chips are produced in the bush. Mobile chippers convert the biomass into a medium-sized solid material. Chipping allows more biomass to be transported using the same transport volume. The main off-taker of wood chips in Namibia is Ohorongo Cement near Otavi which uses chips from encroacher bush to fire industrial combustion chambers, which are designed to accept coal as well as any type of organic matter as fuel. A subsidiary company, Energy for the Future (EFF), was initially tasked with harvesting encroacher bush in a 75 km radius around the cement plant, chip and dry it and deliver it to the cement kilns. Farmers availed their farms for bush harvesting and paid a small fee for the de-bushing. Since EFF cannot meet the demand of the cement factory, the company is now buying chips from third parties. Although several companies started to supply Ohorongo Cement, their demand still cannot yet be met.

Wood pellet production starts with shredding of chips into sawdust like particles. This step is followed by drying the particles; then they are pressed to form sausage like pellets having a diameter of roughly 5 mm. In many cases, a binder in form of starch or molasses has to be added. This processing roughly doubles the cost. Pellets are not yet produced in Namibia. Two companies are known which tried to commence the production based on encroacher bush. The main problem is the sand contained in the wood chips. It results in interruption and even destruction of the pelleting machine and in low quality products.

Challenges Woodchips

- Technical problems: It is reported that chippers break down frequently due to the hardness of indigenous wood and its high sand content that grinds down the hardest steel within a couple of years. However, some producers report no challenges with regard to the chipper. They chip the fresh wood, whilst other producers first air-dry the wood in the field before chipping, which may cause a higher sand content.
- Employment creation by the production of chips and pellets is fairly limited. A mobile chipper can be operated by one unskilled and one semi-skilled worker.
- Lower bulk and energy density than pellets and compressed firewood
- Only competitive with short transport distances (up to 100 km)
- Limited value addition



Chippers convert the biomass into a medium-sized solid material with a typical particle size distribution of 1 to 100 mm, while the main particle size is mostly in the range of 30 to 60 mm.

problems with chippers should be solvable and initiatives to identify technological and process related solutions are currently underway



Challenges Pellets

Pellet production in Namibia has been under consideration for a number of years and international off-takers from Europe, India and Brazil have shown interest. However, production has not materialised to date. It bears a number of risks, including:

- Pellets from Namibian encroacher bush do not comply with quality requirements of main European end-users
- Serious technical problems with sand content of Namibian wood chips
- Higher production costs than wood chips
- Production for industrial end-users competing with wood chips and compressed wood
- No current local demand and hardly any in neighbouring countries (competing with producers in RSA)

the possible demand in Botswana and Zimbabwe should be considered

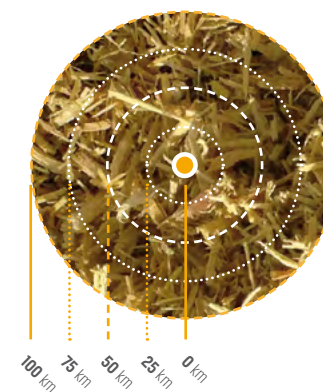
Opportunities

Whether overseas markets can be penetrated by wood chips and pellets depends mainly on quality requirements, production costs, and technical challenges. Chips and pellets from Namibian encroacher bush do not comply with European requirements. However, these requirements hamper mainly the market entrance for households and small power plants, which are the main end-users of pellets. To determine whether industrial users accept the Namibian qualities requires detailed market surveys including existing differences in the potential import countries.

Calculating transport costs is important, in particular for industrial mass supply. Preliminary calculations showed that chip exports to overseas might not be viable. At the same time, regional best practice exists. The NCT cooperative in South Africa exports in excess of 1 million tonnes of woodchips to East Asia every year. There are several options which can influence the costs and thus the viability: Using trucks which return empty from the North would reduce the costs for land transport by about 30 per cent; railway could be used wherever possible; loading at the site into containers would reduce costs; using part-charter vessels which are available in Walvis Bay would reduce ocean freight.

The domestic market is currently limited since wood chips and pellets are only in demand by a few industrial end-users. However, an increasing demand may be assumed in the (near) future. Potential users of chips or pellets could for instance be Namibia Breweries and MeatCo, energy-intensive companies in Windhoek as well as mining and fisheries companies in the Erongo Region. Also NamPower is now in a concrete phase to initiate generation of electrical energy from encroacher bush.

chips might be the preferred form of biomass within a transport distance of up to 100 km



Key strengths further include:

- Experience is locally available and the technical problems seem to be solvable. Furthermore, Namibia has already a domestic demand of 85 000 t p.a. which is currently not satisfied and will increase on short term to 250 000 t p.a.
- Mixed species and finer branches of bushes that are not suitable for the production of charcoal can be used
- Flexible equipment from small mobile chipper to fully mechanised harvesting and chipping machines is available
- Demand for dried and undried chips
- Demand in several industrialised countries not satisfied
- No quality requirement defined for woodchips in Europe

companies from the food sector need heat and steam

a large-scale contribution to de-bushing seems possible if the market of industrial users in Namibia can be penetrated



Animal Feed

Agriculture in Namibia is traditionally and commercially dominated by livestock. One of the major challenges is the availability of feed in the veld because of over-grazing and periodical draught. Therefore, production of animal feed from encroacher bushes would be an ideal value chain.

Production of animal feed from encroacher bush is a controversial point of discussion. No formal chains that add value to bush by using it in animal feedstuffs are operational in Namibia. Independently of the different opinions and experience, the following can be concluded:

- Animal feed can be produced from selected encroacher species.
- Small branches and leaves are the best input material; however, separate harvesting requires additional effort and costs although special machines are available in Namibia.
- Wooden parts of the encroacher species can also be used. Lignin certainly hampers the digestion process, but this is not a serious matter and could be balanced.
- Sapwood (recently grown outer layers) is much more nutritious than the older heartwood because it contains in particular sugars and minerals.

Animal feed production can help farmers in communal and commercial areas especially during dry periods

Value Chain

Considering the current controversial stage of knowledge, the production can either be based on young parts of the bush only (twigs and leaves) or on whole encroacher species, in both cases provided they are edible and not harmful for the livestock. The raw material must be chipped as fine as possible and should finally be mixed with different additives. Pelleting might further improve the suitability as commercial product. Due to the numerous options of the production process, it is difficult to estimate the required investment for a commercial production plant.



Challenges

- Lack of reliable information regarding use of parts or whole edible bushes as well as production process
- Only selected species edible
- Wood component in feed between 10 and 80 per cent
- Demand strongly fluctuating

In contrast to the domestic market, the export prospects are not promising. In neighbouring countries the natural feed supply is either better than in Namibia or it is doubted that a new producer could compete with the established South African supplier.

Opportunities

The local demand is highly variable depending on the annual rainfall and price of the bush based fodder. The fluctuation of the demand is for example demonstrated by the imports of feed: 2,000 t in 2012, 14 600 t in 2013, and 3,200 t in 2014. However, the imports do not at all reflect the actual demand which is by far higher and mainly covered by locally produced lucerne.



Most sources agree that the raw material must be chipped as fine as possible and should be mixed with different additives like molasses.

If the price for bush based fodder is considerably lower than for lucerne, it would open additional markets. Experts estimated a demand that can range between 10,000 tonnes p.a. for a normal rainy season to as much as 150,000 tonnes p.a. in times of drought.

Key strengths include:

- Production of animal feed from selected encroacher species is technically possible
- With competitive prices high local demand
- In contrast to other products a main emphasis on small twigs, leaves, etc.
- Substitution of imported feed
- Decentralised production, also in communal areas, is possible.

FURTHER RECOMMENDATIONS

It is recommended to explore the opportunity further with the following steps:

- Identify species which could be suitable for feed production
- Clarify in practical tests whether lignin is digestible or how it could be made digestible
- Test the suitability of wooden parts in the feed
- Develop different compositions of feed and test them in practice at a research station
- Develop at least two production processes for decentralised small scale manufacturing on farm level and for centralised production including pelleting
- Prepare a full feasibility study including cost calculation and a detailed demand analysis in particular considering communal farmers

even in years of normal rain there is often not sufficient feed in communal areas for optimal livestock husbandry



Poles

After firewood, poles are the main product currently produced from Namibian forests and encroacher bush. Pieces from about 5 cm in diameter can be used. Poles are mainly used for construction of traditional houses and fencing, but also for special uses such as garden bed edgings.

large poles, e.g. for telephone lines are excluded here, because such dimensions are not available from encroacher bush

Traditionally, poles are harvested wherever needed and available. They are mainly used by communal and commercial farmers, but are also sold informally. Formal sales are very limited. The only known commercial resale of Namibian poles is by Pupkewitz Megabuild in Windhoek, Katutura. Due to the informal character of the production and marketing of poles, neither the quantities nor the number of producers or employment and income generation are known.



Mechanised harvesting of encroacher bush for pole production

Value Chain

In the formal trade worldwide, the market usually requires standardised straight length and diameter, differentiation by timber species, resistance against decay and termites because of the outside uses and de-barked products. Internationally, nearly all commercial poles are from man-made forests with clear separation by species and age and straight growth. After harvesting and cutting to length, the poles are manually or mechanically de-barked, in most cases already in the forest. Thereafter, they are transported to wood protection plants where they are treated under high pressure, e.g. with salt that enters the cells. Such poles have a guaranteed lifetime of up to 30 years.

Studies found that Namibia produces 334 000 m³ of poles per annum; moreover, wooden poles to the value of about N\$ 2 million are imported. In addition to wooden poles, farmers use mainly imported poles from metal and synthetic material for fencing. The contribution of locally made poles to the formal market is very limited and some retailers (Pupkewitz Megabuild, nurseries) indicated that they could sell more poles.

Challenges

Disadvantages of pole production from encroacher bush are the growth form which is in most cases not straight, and the mixture of different species, which requires sorting for certain end uses. Further challenges include:

- Competition from imported wooden poles and poles from other materials
- Hardly any formal value chain in place
- Harvesting sometimes in environmentally sensitive areas and even of protected species
- Mostly unreliable supply
- Production not in line with demand requirements, e.g. no grading by species, limited treatment

Opportunities

Poles have a stable demand in Namibia that will continue in the future.

The prospects for a local production can be seen positively. Most of the technical problems can easily be solved, for instance de-barking, separate sales of poles from resistant higher value species and full painting with tar. This will already increase the value, although the disadvantages versus important wooden poles (limited straightness, no pressure treatment) have to be balanced by the prices. Another option to increase the value of the harvested poles is a planned cutting by lengths (which is not known at all), considering right from the beginning the different products demanded to reduce the waste.

Furthermore, the market share of locally produced poles can be considerably increased if local entrepreneurs are informed about opportunities and mobilised to start formal pole businesses in an organised market. This requires some training, e.g. in marketing and a mobilisation campaign.

- High local demand
- Resources available at low cost
- Some species resistant against decay and termites
- No skills required
- Very low investment
- Potential of income generation for disadvantaged people as self-employed or SMEs
- Few additional inputs required



In addition to wooden poles, farmers use mainly imported poles from metal and synthetic material for fencing.

huge domestic market, particularly at commercial farms and in communal areas



Traditional Medicine

Hundreds of plants are used in Namibia for traditional medicine. Although traditional medicines in Namibia have often been replaced by imported pharmaceutical products, especially among the younger generation, they still play an important role nationally and internationally.

The annual trading volume in South Africa is estimated to be at least 300 million Rand. In Asia and Western countries, traditional medicine enjoys increasing demand. Namibia currently exports only devil's claw. However, collection, processing and marketing of other traditional medicinal plants available in encroacher bush could be a promising business for sale in Europe and North America with high value addition.

Such a use could only become reality after longer term research, which should include the following main steps:

- Identification of species and respective parts of them which are used as traditional medicine; this should be done together with experienced local people
- Determination of the available quantities. Only if sufficient quantities for exports are available, the project may become feasible
- Investigation on the possible applications and acceptance by foreign health authorities
- Preparation of a comprehensive feasibility study
- Identification of international partners with respective experience to plan and implement the project



Medicinal products made from Namibian devil's claw

PICTURE ON OPPOSITE PAGE

Native to Southern Africa, devil's claw (*Harpagophytum procumbens*) gets its name from the tiny hooks that cover its fruit. Devil's claw is known to treat pain, liver and kidney problems, fever, and malaria. It has also been used in ointments to heal sores, boils, and other skin problems.





Wood-Cement Bonded Bricks or Boards

Construction materials based on wood and cement are produced in numerous types. The wood particles are essentially an organic aggregate in the concrete mixture, while cement acts as wood particle binder.

a major application in Namibia could be the construction of houses

Numerous products are manufactured on the basis of wood and cement, such as solid or hollow bricks, panels and prefabricated walls. They are used as outdoor construction material for partitioning, ceilings, acoustics applications, wall cladding, roofing and shuttering.

Wood-cement based products are commonly accepted by the markets, in particular in industrialised countries, because of their excellent properties. They have an excellent thermal insulating capability and a low or non-combustibility, a characteristic of extreme importance in the construction industry. Additional important properties of these products are that they can be worked by normal woodworking tools and are environmentally friendly.

an advantage of a Namibian production is the availability of cement

Value Chain

A typical production process, after harvesting of the wood, consists of the following steps: The wood is de-barked, chipped and fine grinded. Coarse material is used for the inner board layer, fine material for outer layers. The particles are dried and then mixed with cement, chemical additives and water. Additives are used for example as curing accelerators. The mixture is conveyed to a forming machine, where it is distributed and deposited on steel plates. In a curing chamber under steam, pressure, humidity and time, the product is hardened and can be processed further. The thickness of the final board can vary between 8 and 60 mm.

Although small capacities of 10 000 m³ p.a. are reported, economically viable plants in industrialised countries have an output of 50 000 m³ p.a. and require investments of €20-30 million.



Challenges

Sufficient raw material from encroacher bush is available in Namibia, but the following challenges have to be considered:

- The normal resource basis is softwoods. Encroacher bush consists only of hardwoods and their properties are not known, i.e. it is necessary to determine first the wood properties of the species.
- It is assumed that not all species can be used, i.e. sorting by species is required.
- Bark hampers the production or even makes it impossible. Therefore, it must be tested whether any bark content is acceptable or the wood must be de-barked.
- High investment (€20-30 million) for a minimum output of 50 000 m³.
- Most personnel to be semi-skilled and skilled
- Considerable marketing required to introduce the "new" products in Namibia.

Opportunities

Statistical data about the demand of the respective products are not available, but the demand is steadily increasing in particular in environmentally oriented industrialised countries. Main reasons are that the production is based on natural resources and the products have excellent properties.

In Namibia, the products are hardly known, but based on a model calculation already in 2002 a domestic demand of 40 000 m³ p.a. was estimated. Due to the fact that with the exception of cement most building materials are imported, it should be possible to mobilise the demand especially amongst high-end customers. Depending on the price, also the low cost housing sector could be an option for panels, since they can easily be assembled.

- Excellent properties, e.g. with regard to thermal insulation, vapour diffusion, resistance to moisture penetration, durability etc.
- Panels easy to assemble and workable with normal woodworking tools
- Possible substitution of other imported building materials
- Main input materials (wood, cement) locally available
- Known and applied technologies available
- Competitive costs compared to other building materials
- Employment creation for about 100 people at a plant with 50 000 m³ output.

**recommendation:
involve an
international
partner with
experience in the
production of
these products**



Medium Density Fibre Boards (MDF)

MDF boards have a smooth, homogenous structure which allows easy lacquering, laminating and printing. The most important applications are furniture production, building boards and laminates for furniture and flooring.

MDF are worldwide the second most important panels with a production nearly as large as particle boards and oriented strand boards (OSB). MDF production is well established worldwide and the required technologies are readily available.

Value Chain

In a typical production process, wood is harvested, de-barked and chipped. Wood chips are then steamed before passing a refiner. The coarse fraction is used for the inner layer of the board, the fine fraction for the outer layers. The fibres are dried, glued and pressed. After pressing the boards are cooled, trimmed and sanded and are ready for selling or can be

laminated. Board density varies from 650 to 850 kg/m³, thickness from 2 to 60 mm.

The normal capacity of a modern MDF plant is 500 000 m³ output per annum, requiring an investment of about €200 million. However, also smaller plants with capacities of 75 000 – 100 000 m³ can be viable depending on the material and labour costs as well as local market prices.

There is no production in Namibia, but tests have been made. Mainly thin branches were used; fibres were produced with a hammer mill and afterwards cooked and washed. The fibres were put manually in a form and pressed without using additives (glue). Although the project was not developed to an industrial scale, due to a lack of financial means, it indicates at least that a production of fibreboards might be possible.

Challenges

From encroacher bush in Namibia sufficient raw material is available, but the following challenges have to be considered:

- Preferred raw material for MDF is softwood of which fibres are longer than from hardwood and their density is lower. Hardwoods can be used in a mixture. Higher hardwood shares require more intensive gluing and the dimension stability of the board is affected.
- Generally, high density of the wood is a draw back with regard to chipping, refining and (high) board density. MDF made of this material is more expensive compared to MDF from pines and will have problems in the international market penetration.
- Bark reduces the quality of the boards. For furniture production bark is not accepted at all since with sanding the bark may come off and reveal small holes.



MDF does not contain knots or rings, making it more uniform than natural woods during cutting and in service.

Opportunities

Competitive production for the world market is not possible, since MDF based on Namibian encroacher bush with its hardwood cannot fulfil the international quality requirements. Furthermore, production for the world markets would require a plant with an output of 500 000 m³ p.a. and investments of about €200 million.

However, a production in small capacities could be envisaged, targeting the domestic market and other African countries. In this case it might be possible that also lower quality requirements are accepted and such a production could substitute imports of competing products such as particle boards.

- Known and applied technologies available
- Selected encroacher species suitable for production, including small branches
- Employment creation for about 100 people
- High demand in other African countries
- Possibly import substitution of comparable materials
- High value addition by use in the furniture industry.

export possibilities!

FURTHER RECOMMENDATIONS

Considering a MDF production in Namibia would require the following actions step-by-step:

- Select suitable species
- Test the production, considering also the effect of the bark content and the glue requirements
- Investigate the domestic market and the demand in other African countries
- Prepare a feasibility study for a plant capacity of 75 000 – 100 000 t p.a. and compare the viability with large-scale international plants based on softwood

main input materials for MDF production are wood chips also from smaller branches



Wood-Plastic Composites (WPC)

WPCs contain a large group of products. The mixed use of the two materials is relatively new also in industrialised countries. In Namibia, WPCs might be an interesting option for special products for indoor construction, furniture production and agriculture.

WPCs consist of a mixture of saw dust like wood particles and polypropylene or polyethylene. The weight ratio of wood and plastics varies between 70 to 20 per cent and 20 to 80 per cent. Market products contain at least 30 per cent plastics. Their excellent properties and the fact that the end products are easily workable are the reason for the increasing demand in industrialised countries.

products are highly water resistant and stable against shrinking and biodegradation



Value Chain

The bush material is delivered in form of medium-sized chips and twigs (2 cm²). The chips have to be dried and are then shredded to the desired size (3 mm powder). The shredded fibres are pelletized. An extruder machine mixes and melts all material and presses it in moulds. After the material is moulded, it is cooled down and cut to pre-programmed lengths.

The investment for the equipment and machinery varies considerably depending on the degree of mechanisation, whether pellets are purchased or pelleting has to be done at the plant, etc. A huge cost factor is the moulds which determine the shape of the end product. One mould costs between N\$50 000 and N\$200 000, for extraordinary shapes even up to N\$500 000. Considering these factors, investments between N\$10 million and N\$30 million are required.

Tests with biomass from Namibian encroacher bush revealed that the mixed species composition is suitable as input material. Not only selected parts but the entire bush can be used, including leaves.

Challenges

- Plastics to be imported
- Product specific moulds fairly expensive
- Considerable market research required to determine optimal product range.
- Products relatively expensive, i.e. marketing efforts required to introduce "new" products in Namibia

Opportunities

- Excellent properties, e.g. regarding water resistance, shrinking, biodegradation
- Mixed species and all parts of encroacher bush useable according to local information
- Known and applied technologies internationally available
- Considerable know-how and experience in polymer industry available in Namibia
- Large, variable product range
- Import substitution possible
- High value addition
- Flexible investment (N\$10-30 million)



Although WPCs do not corrode and are highly resistant to rot and decay, some caution needs to be taken as they do absorb water into the wood fibers embedded in the material.

Depending on the moulds, a huge variety of products can be manufactured in a WPC plant, for example poles or droppers for fencing, sticks and handles for tools, boards for kitchen tables and cupboards, school furniture, interior design parts for cars, strips for rooms such as cornices and skirting, outdoor flooring.

The advantage of the huge variety of WPC is also the major drawback for the implementation of production in Namibia. Most products target niche markets with a demand currently not known. Therefore, it is recommended to further investigate the possibility to establish a plant in Namibia. Tests should be conducted to verify the suitability of mixed species for the WPC production. The production costs for a very limited number of products should be determined and specific products identified which could be produced in Namibia.

Ideally a WPC production should be implemented by or in cooperation with the existing plastic industry in Namibia, since their know-how would be an asset for the project. Therefore, it is recommended to identify and mobilise potential partners and involve them already in the planning phase.

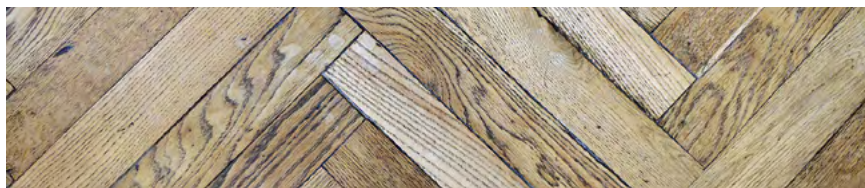


The industry leader, Trex Company Inc., produces decking boards as shown above.

nearly every design can be offered: luxury cars use WPC with a woody appearance for interior design



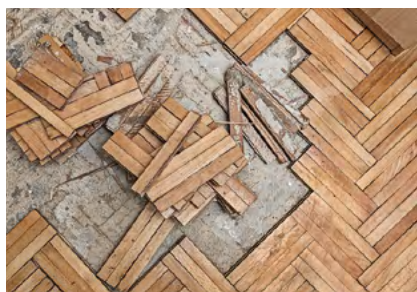
Small-Scale Opportunities



Parquet

This type of flooring is popular in European and North American countries, but also with higher income groups in Namibia. For parquet, wood of high density is required, a condition that is fulfilled by encroacher bush species.

The single elements are relatively small and if larger elements are required, strips could be glued together. Insofar encroacher species could be considered for a production in Namibia.



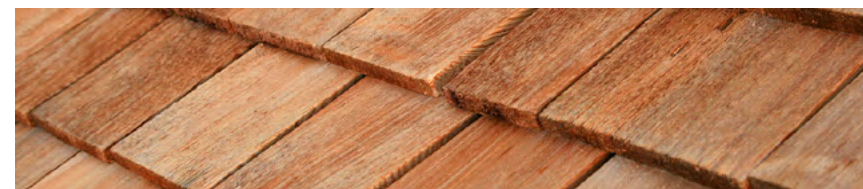
However, the wood also has to fulfil the following requirements, among others:

- Availability of sufficient quantities of one species with attractive appearance
- Limited shrinking, swelling and bending
- Good gluing properties

Further challenges might be the production costs of first sawing the small round-wood and afterwards drying the sawn timber in a kiln.

Despite the challenges, it is recommended to further investigate the option of parquet production, i.e. identify species which might be suitable and test their properties.

Parquet is versatile and available in a sheer endless number of designs and wood species.



Shingles

Shingles are a traditional roofing material in particular in southern Germany, Austria and Switzerland. They also enjoy increasing demand. They are, even in these countries with very high labour costs, mainly produced manually. There are no specific machines available. "Split Shingles" are more natural as they are split by an axe along the natural fibre. "Saw Shingles" are cut without considering the natural fibre directions. This could partially be done with a customised, partly mechanised "log splitter".

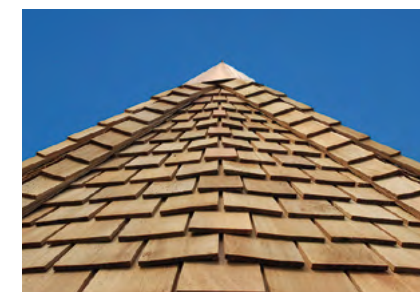


Many countries have a tradition of using wood shingles. Hardwood shingles are known for being naturally resistant to moisture, insects and decay.

Important requirements, such as the natural durability, should be fulfilled by some encroacher species. Drawbacks might include: A conservative demand, since the traditionally oriented customers may prefer to use local species

- Small dimensions of the round-wood
- The fibre direction, which must be straight

It is recommended to consider shingles as a value addition product, but to investigate the demand before testing the properties.





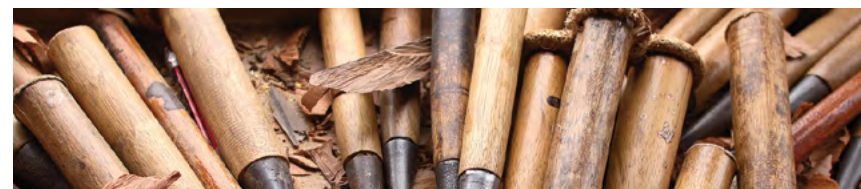
Wooden Frames & Kitchen Boards

Both products have the advantage that they are and can, respectively, be produced from small strips of sawn timber which can be glued together. These products are currently nearly exclusively imported. The imports of frames into Namibia amount to a remarkable value of over N\$5 million p.a. between 2012 and 2014.

It can be assumed that suitable species are available within encroacher bush. Costs could be a challenge because the wood has first to be sawn, which requires at least a table circular saw. Moreover, only strong wood is suitable.

The production of frames and kitchen boards can be feasible. It does not require any detailed investigation but an entrepreneur who tests this potential use with high value addition.

Cutting boards could be produced from small strips of sawn timber glued together



Sticks & Handles for Tools

Currently some sticks and handles are produced manually in rural areas. They have a very poor quality and are sold to the poorest segment of the population. Traditional walking sticks of better quality are also produced for local people and as souvenir for tourists. However, the vast majority of these products are imported.

Machines to manufacture broom sticks and different handles (e.g. for brushes, hammers)

are available for US\$1 800 - US\$2 100 (ex People's Republic of China). Their production capacities are assumed to exceed the entire local demand, but a demand certainly also exists in northern neighbouring countries.

No detailed investigation is required, but a local entrepreneur should be identified to select suitable wood species from encroacher bush and start the business.



Wood Glue

It is a known fact that glue can be produced from ingredients of wood, e.g. tannins. Research is ongoing in Namibia to develop a natural binder from encroacher species for sand boards. However, there is also concrete experience in other countries including RSA.

Outstanding questions are the financial viability versus competing glues, the availability of

encroacher species with sufficient suitable ingredients and the local demand.

Considering the already existing experience, it is recommended to approach experienced companies, e.g. from RSA, which may have a stake in using their knowledge for an economic commitment in Namibia.



Smoking/Aromatic Material

Woody aromatic material has a small but increasing local (in particular private) market. It is used to aromatise meat or fish and is currently often imported and marketed at high prices. It could be considered as by-product (residue) of wood chipping, sawing or production of sticks and handles.

Production of smoking material can only be a very small business, but the effort and investment are minimal. A local entrepreneur has only to test which types of saw dust or chips are suitable and demanded depending on the timber species. Thereafter, only investments in packaging and marketing are required.



Carving

Carving is a traditional activity in several parts of Namibia, nowadays focusing mainly on the tourism market. Suitable species are available. Due to the widespread local experience and the assistance a lot of carvers received in the past as well as the knowledge about suitable timber

species amongst carvers, no special actions are required. However, it should be considered to supply carvers with wood from de-bushing since currently local carvers often use (also illegally harvested) bigger trees.

Key Considerations for Businesses Based on Encroacher Bush

- ✓ For mass products like wood chips and industrial processing with larger capacities, quantities, access, costs and procurement risks are especially important.
- ✓ With regard to the quality of the biomass, some end-products, like wood-cement bonded bricks, can only process species with specific requirements whilst for instance all mixed species can be converted into charcoal.
- ✓ The procurement risk is in particular important when the biomass is further processed on industrial scale or the market expects continuous supply.
- ✓ With regard to "other input materials", there are huge differences concerning the location requirements. Some products, like charcoal, are based on the woody biomass only, whilst others require additional raw material, water, electricity and auxiliary materials (e.g. wood-cement bonded boards).
- ✓ Access to the demand markets is a precondition for all end-use opportunities. Based on the good Namibian infrastructure and its international links, only a few products require proximity to the local markets.
- ✓ For industrial investments personnel requirements are one of the most important criteria. Lack of suitable personnel may not only increase labour costs considerably, but it also requires enormous additional costs, e.g. for schooling, housing and social welfare. On the other hand, businesses based mainly on semi-skilled and unskilled personnel do not consider these issues as important criteria for the selection of a location.
- ✓ Availability, reliability and costs of services are an influence, also mainly with regard to larger or industrialised businesses.
- ✓ The availability and costs for land and buildings are in principle important for all businesses.

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There are numerous end-use opportunities for encroacher bush. Some products require large quantities of resources. Others use much smaller amounts but may still lead to considerable value addition as well as to the creation of small and medium enterprises and employment.

This brochure showcases potential products made from encroacher bush, considering international best practices, traditional uses and emerging opportunities. It explores the value chains of wood products for heating and energy, for the agricultural sector and for the construction industry.

The especially large demand of the energy sector may trigger large-scale bush harvesting projects.