

# Potential of Natural Dye Processing in Matabeleland South Province: Case Study of Masendu Ward, Bulilima-Mangwe District, Zimbabwe.

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## Abstract

Synthetic dyes are non-biodegradable. There is a quest in the dyeing industry to replace these with natural dyes. The availability of raw material is a pre-requisite in assessing the manufacturing of any product. This paper outlines the results of a survey to determine the availability and distribution of natural dye trees in Zimbabwe's Bulilima-Mangwe District. Other plant uses are highlighted. Fifty-eight different plant species were identified. Forty one and fifty-nine percent of the plant species are dye and non-dye plants respectively. With improved technology and commercialisation techniques, the district will benefit from the natural dye business venture.

**Keywords:** natural dye plant species, dye, availability, botanical, uses

## 1. INTRODUCTION

Nature is full of fascinating colours without which life would have been dull and monotonous. Until the 19<sup>th</sup> century natural dyes were the main colorants for textiles. Artificial dyes were then introduced. The latter are easier to apply than the natural dyes. Besides a wide range of available colours, higher reproducibility and improved quality of dyeing could be achieved at lower specific cost [1]. Natural dyes cost have to be lowered considerably and the quality level of the dyeing needs substantial improvement [2]. According to Pan et al (2003) [3] the concept for production of natural dyes with lowered specific cost involves use of cheap by-products from other agricultural activities, like bark from the timber industry or leaves from abundantly available plants as deodar, jackfruit and eucalyptus.

Synthetic dyes are non-biodegradable. There is a quest of replacing these with natural dyes in textile coloration addressing issues to do with environmental awareness, ecology, pollution control and sustainability [4]. Natural dyes are neither toxic nor polluting [5]. Considerable research has been done around the world to discover new sources of natural colouring agents and especially those with lower costs in order to make these textile

products as popular as possible [6]. Most of the natural dyed textiles are imported from Third World Countries and India is still a major producer of natural dyes [12].

### 1.1. CASE STUDY: MASENDU WARD

Masendu ward in Bulilima District is situated 53km north of Plumtree Town along the Plumtree-Ndolwane road. The ward consists of five villages namely Tandawana, Tjeboroma, Masendu, Central, Livuluma, and Mambo. The ward covers an area of 42km<sup>2</sup>. Each village has approximately 480 households with an average of six people per household and a total population of about 3600 people. Livestock rearing and crop production are the main economic activities. The village has close to 800 youths that are largely unemployed [13]. The plant species in this ward have diverse kinds of uses. These include food (wild fruits, leaves nuts, roots tubers flowers, bark, sap, porridge), fibre and material (bark, thatch, reeds, wood, fertilizer), cosmetic and medicinal (medicines, toxins), plants extractive (dyes and gums), firewood as well as in making poles.

Mostly, women from Masendu ward use agave americana L., agave sisalana (sisal) and hyphaene petersiana (ilala palm) for basketry and craftwork. However, they use

coloured poly propylene threads from either orange or potato bag materials that are non-biodegradable to improve finish their products. Harmful effects of these threads and synthetic dyes necessitated the need to look for eco-friendly natural dyes around the area.

A survey to explore the abundance of the renewable source of producing natural dyes from abundantly occurring and easily available plants was done in Masendu ward as expounded in the paper.

## 2. METHODOLOGY

The survey is a pilot study towards the establishment of natural dye processing as an income generating project in the ward. The aim of the survey was to identify existing plant species, and to determine the proportion of potential dye species to non-dye species. The survey was carried out in five different villages. Five research experts were each accompanied by ten villagers who could identify the names of the trees in vernacular during the survey. For the validity of the results, the area covered was a hundred by hundred square metres in each village. The templates for local names, family species, habit, height, parts used for dyeing, colour produced, regeneration method, plant uses and use values were completed. The approximated heights were calculated.

Literature review on plants, their uses and respective botanical names was done to verify the results.

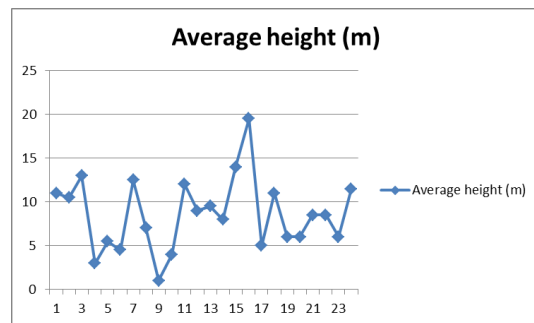
## 3. RESULTS

The plant species identified were creepers, shrubs, small trees and big trees. Figure 1 shows the distribution of the average heights of the potential dye species available in the ward. The maximum height of the trees is 19.5m whilst the minimum is 1.0m. According to Lenard (2008) [14], the height ranges of 7 m, 8-15 m and over 15 correspond to distinguished size categories of small, medium and large, respectively. From the analysis 41.7%, 54.2% and 4.2% are small, medium and large species respectively. This shows that dye extraction from various plant parts is inevitable. No advanced mechanism is required to reach out to the dye source.

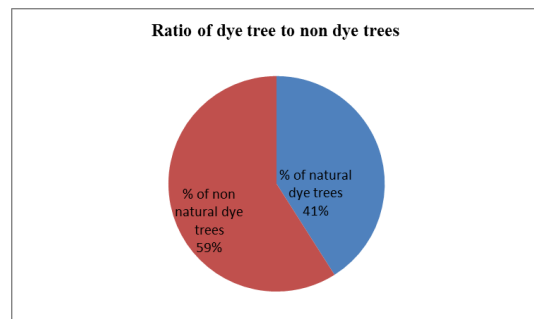
**Appendix A** shows a list of natural dye plant species present in Masendu ward. Local, common and botanical names are compiled

accordingly. Twenty-four out of fifty-eight of the plants were identified as potential natural dye plants (Appendix A). The type of a habit is crucial. According to a dictionary gardening [15] habit is defined as the characteristics of a plant's appearance, concerning shape and growth and plant type (i.e. herb, shrub or tree).

Forty one percent of the trees in the ward are natural dye plant species whilst fifty-nine percent are non-dye-plants. Figure 2 shows the ratio of dye to non-dye tree species in the whole ward.



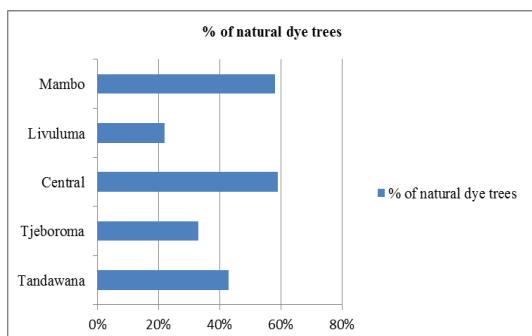
**Figure 1.** Distribution of the average heights of the potential dye species



**Figure 2.** The ratio of dye to non-dye tree species in the whole ward

**Appendix B** shows the number of dye and non-dye tree species in 100m<sup>2</sup> area in respective villages. Figure 3 shows the percentage of dye to non-dye trees in Masendu ward. Of the tree species identified in different villages, 43% in Tandawana, 33% in Tjeboroma, 59% in Masendu Central, 22% in Livuluma and 58% in Mambo village were natural dye plant species. Dye species are more dominant in Masendu central than in other villages. If centralised dye processing is implemented, then the manufacturing plant should be located in Masendu central where the raw material is prevalent.

Dye is extracted from the leaves, stems, flower heads, barks, roots, outer skins, heartwoods and wood shavings, berries and seeds. Dye colours include shades of green, beige, orange, pink, red, blue, yellow and brown. Colours include shades of green, beige, orange, pink, red, blue, yellow and brown.



**Figure 3.** Percentage of dye to non-dye trees in Masendu ward

#### 4. DISCUSSION

Although the natural dye trees species (41%) have been relatively accessible to the village artisans, lack of knowledge on natural dye tree species is of some concern to people who are doing basketry and other craft products [16]. The yellow-brown, hard-wood from *Berchemia discolor* make a good furniture wood for stools, mortar and pestle, wooden plates but its scattered occurrence prevents any large scale use.

The 43% in (**Appendix B**) that constitutes dye plants in Tandawana village is a forest wood, which consists of a variety of natural dye plants. Although there is a wood forest in Tjeboroma village, most of the plant species identified were the mopane and *Cassia abbreviata* trees that are non-dye plant species hence a decline in the percentage of natural dye plants identified in this particular village. Livuluma village has the least percentage of natural dye plants. Its dominant tree species is *Combretum collinum*, which is not a potential dye plant. However the gum-tree plantation in this village allows villagers to extract the dyes as it produces a brown colour.

According to villagers, *Julbernardia globiflora* is useful for ropes that are used to make beehives and stitched canoes, cornbins and sacks for the villagers. Fruit from *Parinari curatellifolia* is much sought after by the local

people and consequently the trees are seldom chopped down. With its pleasant tasting yellow flesh, it has a variety of uses and is a staple dietary item. It is either eaten as it is or made into porridge as well as providing the basis of a refreshing non-alcoholic drink. An extract from the bark is used in tanning and also a hot formant for the treatment of pneumonia [17]. The hard light brown wood is borer-proof and although it is not durable if left exposed to weather, it has been used fairly extensively for rafters, beams, poles and benches. Unfortunately silica crystals in the wood make it difficult to work, as they blunt saw-blades and other tools very rapidly [17].

*Euclea divinorum* has round, thinly fleshy fruits that are edible though not very pleasant to taste. Villagers use these fruits to make a purple ink and in the brewing of beer. The bark produces a black dye used in the dyeing of basket ware. The frayed ends of twigs make effective toothbrushes for the villagers and the branches are effective for beating out bush fires.

People in Masendu use the soft and fibrous bark of a Baobab tree, to make excellent ropes and floor mates after pounding them. The seeds embedded in the fruit are refreshing to suck, and when soaked in water, make a palatable drink, that has been used to treat fevers and scorbutic complaints [17].

*Vitex payos* has ovoid to almost round, fleshy, shiny black edible fruits, which have a distinctive coffee-like flavour and are much sought after by local people. The fruits have a rather unpleasant smell, and leave a temporary black stain on the teeth [18]. It gives a purple colour when used as a dye. Its can be used in dyeing natural fibres such as sisal.

According to the villagers, the ash from the burnt *Piliostigma thonningii* wood is soapy and the green fruits provide a substitute for soap in the rural areas. The bark contains a fibre, which is used as string and is also made into rope. The pods in the fruit are food for game and stock animals and can be ground into a meal with equal nutritional value as maize meal [17]. It is essential for the rural people to dry the pods first or they tend to jam the crushing machines. In times of famine both the pods and the seeds have been eaten, and all the parts of the tree are

widely used medicinally to treat colds and headaches tummy aches.

*Sclerocarya birrea* also has diverse kinds of uses. Because the fruits have a rich scent, they are made into an alcoholic drink of some potency, an excellent conserve and a delicious amber-coloured jelly, all of which must have considerable nutritious values as the pulp contains four times as much Vitamin C as orange juice [19]. Each fruit also has a single stone, inside which there are two or three seeds containing oil rich in protein. These nuts may be eaten raw or cooked with porridge [20]. They are also crushed and boiled in water, and the resulting oil is skimmed off and massaged into the skin as a cosmetic. The bark, which has an astringent taste, is widely used in the treatment of dysentery, diarrhoea and malaria.

The wood from *Ficus sur* is light and soft and has practical uses. According to villagers, drums are sometimes made from it. Its fruits, the figs have a sweet, insipid flavour but they can be used to make jam provided they are not unpleasantly full of insects, as is often the case. In traditional medicine, burns and septic conjunctivitis are treated with an application of its latex and an infusion from its leaves and bark is administered to cows to boost their milk production. They also provide shed for both villagers and their livestock.

*Pterocapus angolensis* serves a number of purposes in the rural community, both utilitarian and in traditional folk medicine. When cut, it exudes a red, sticky and blood-like sap that leaves a permanent stain on cloth and makes therefore an effective dye. The sap may also be used as cure for nose bleeds. The inner bark of roots, powdered and mixed with fat, has provided an ointment for anointing the body. According to the villagers, the bark, when heated in water and mixed with figs, can be massaged on to the breasts to stimulate lactation in humans; a cold infusion from the bark alone provides a remedy for nettle rash or maybe taken to relieve stomach disorders and mouth ulcers. They also say that either the bark or the root, boiled with fresh meat, is used as a preliminary accelerator in the treatment of gonorrhoea. Palgrave [17]'s study indicates that a decoction of roots is believed to be a cure for malaria and black water fever, and when cleaned and left to soak in water for six hours, they produce eyewash in which corneal ulcers are bathed. The golden or reddish brown heartwood makes high quality

furniture as it is easily worked; glues and screws well and take a fine polish. It is used as well to make mortars, dishes and drums.

*Terminalia sericia* provides a useful purpose timber the wood is suitable for furniture. A decoction of the roots, which has bitter taste, which according to villagers, cures diarrhoea, relieve colic eyewash, a hot infusion of the roots outer layers makes a fomentation for treating pneumonia.

Soft and lightwood from *Lanea discolor* is suitable for fishing-net floats as well as for dishes and stamping blocks. Medicinally, the villagers say that the bark and roots are taken for the variety of ailments particularly children complaints ranging from fever to constipation. Twine may be made from the stripped bark.

*Branchystegia spiciformic* provide fine shade and the bark is astringent, containing 13% tannin, an extract is used as a final dressing in tanning hides as it imparts a reddish colour to the finished product. This can act as a mordant as it improves the affinity of fibres to natural dyes.

## 5. CONCLUSION

Although this survey was hinged on discovering potential dye plants, it was also discovered that they have various other uses such as medicinal. The diversity of natural resources found within the Masendu ward and the equally diverse rural livelihood activities suggests that there is a range of opportunities that can be derived from their management and utilization. The ratio of natural dye to non-dye tree species in the ward is a clear indication that natural dyeing is feasible in Masendu ward. With more research on availability of natural dye plants, more species can be discovered to be potential dye plants. Expanding current levels of natural dye extraction and commercialising the dyes is encouraged. Shortages of certain tree species are often quite localised and craftsmen respond by shifting their collecting sites. In this case they can network with other villages for different natural dye species.

It is recommended that the qualities and quantities of dyes (from the leaves, fibres and trunks) from the different species of trees be determined. This data will help determine if the qualities of the dyes are competent with the existing dyes and provide cost estimates to indicate the viability of the project. Environmental, social, economic impacts of

this project on this community should be studied further.

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**Appendix A: Natural dye plant species found in Masendu ward [16][17], [21]**

No.	Local names	Common Names	Botanical names	habit	height	Uses	Parts used	Colour
1	Ishungu/umshonkwe	Munondo	<i>Julbernardia globiflora</i>	tree	7-15m	dye/furniture/mortar/ beehives, ropes, stitched canoes, corn bins, sacks	stern/bark/ropes bark	pink/brown
2	Umbola, umukhuma, muhacha	Mobola-plum	<i>Parinari curaterifolia</i>	tree	8-13m	furniture/medicinal/porridge/fruit/drink	bark/ fruits/stern	purple/brown/pink
3	Umnyi	Bird-plum (Pink Ivory)	<i>Berchemia discolor</i>	tree	6-20m	fruit/dye/furniture	bark/roots	brown/pink/red/black/orange
5	Incena, inhlaba, gavakava	Aloe	<i>Aloe excelsa</i>	herb	2-4m	dye/medicine	leaves/flowers/roots	yellow/beige/pink-brown
6	Umtshekesane, mushangura	Diamond leaved euclea	<i>Euclea divinorum</i>	Shrub	3-8m	Dye/beer/ink/tooth brushes/fire extinguishers	roots, skin of roots	brown/pink/orange
7	Umviyo, umthofu	Ant-heap wild-medlar	<i>Vangueria randii</i>	Shrub	1-8m	wild fruit/dye	leaves	yellow, green
8	Umkhomo, muuyu,	Baobab	<i>Adansonia digitata</i>	tree	10-15m	dye/fruit/porridge/ropes/floor mates/ medicine	fruit fibre	brown, green, pink
9	Umthsangela, mutsubvu	Chocolate-berry	<i>Vitex payos</i>	tree	4-10m	fruit/dye/door frames	bark	purple
10	Ntululi			herb	cripper	dye	roots	white
11	Musekesa/lhabahaba	Monkeybread	<i>Piliostigma thonningii</i>	tree	3-5m	Dye/soap/strings/rope/mealie-meal/ medicine	Pods/dye	Beige, grey, pink, brown
12	Umganu, mupfura,	Marula	<i>Sclerocarya birrea</i>	tree	7-17m	dye/drink/jelly/wine/jam/oil/nuts/ cosmetic/medicine	bark/fruit	brown/pink/red/purple
13	Musvinwa			tree	8m	fruit/dye	fruit	red/brown
14	Ububese, mukuyu	Broom-cluster fig	<i>Ficus sur</i>	tree	7-12m	dye/drums/igniters/jam/medicine/fruits/fertilizer	branches/leaves/bark	pink/brown/purple
15	Ithetshane			tree	7m	dye	leaves/flowers	
16	Umvagazi,mubvamaropa	Mukwa	<i>Pterocarpus angolensis</i>	tree	12-16m	dye/furniture/poles/medicine/ointment	bark/branches/liquid	red/brown/pink/beige
17	Umgamutiri, mupuranga,	Gumtree	<i>Eucalyptus spp.</i>	tree	14m	dye/medicine/poles	bark/leaves/trunk	yellow/green/beige/brown
18	Umangwe, mususu,	Silver terminalia (mangwe)	<i>Terminalia sericea</i>	tree	4-6m	Dye/timber/medicine	bark	yellow
19	umpanda			tree	7m	medicine/dye	bark/roots	blue
20	Umthewa	Grey raisin	<i>Grewia monticola</i>	shrub	2-10 m	Plaits/sticks/assegai handles	stern	
21	Intolwane, muzezepasi	Elephant root (Narrow-pod)	<i>Elephantorrhiza goetzei</i>	tree	5-7m	dye	bark/roots/leaves	black/brown
22	Isigangatsha, mushamba	Live-long	<i>Lannea discolor</i>	tree	2-15m	dye/poles/firewood/fishing-net floats/ dishes, stamping blocks/medicine/twine	bark	brown
23	Umqathuva			tree	3m	Dye/mouthwash	leaves/roots	orange
24	Igonde	Musasa	<i>Branchystegia spiciformic</i>	tree	8-15m	dye, poles, firewood/shade/ tannin/medicine	bark	brown/purple/pink

**Appendix B: Number of dye and non-dye tree species**

<b>Village</b>	<b>Tandawana</b>	<b>Tjeboroma</b>	<b>Central</b>	<b>Livuluma</b>	<b>Mambo</b>
No. of non-dye tree species	32	29	9	45	11
No. of natural dye plant species	24	14	13	13	15
Total no. of tree species	56	43	22	58	26
% of natural dye trees	43%	33%	59%	22%	58%