

# How tree seedling nurseries are furnishing landscape agrobiodiversity in Zambia

Producer organisation: Choma District Tree Nurseries Association (CDTNA)



## Agrobiodiversity Case Study 6: Zambia

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## Summary

This case study investigates how the Choma District Tree Nursery and Growers Association (CDTNA) is helping its smallholder members to improve and maintain agrobiodiversity in their local forest and farm landscape. The association is unusual in that it focuses on the supply of inputs (planting materials) for agroforestry, rather than production from any particular forest or farm producer organisations. While CDTNA does not use the term 'agrobiodiversity' in its objectives, the association is a key player in promoting, supplying and sharing planting materials and knowledge to support on-farm agrobiodiversity.

Established in 2017 to address the socioeconomic needs of local tree growers, CDTNA's membership maintains a set of nurseries within the premises of the Choma district's Forestry Department timber yard where they raise more than 338,000 of assorted seedlings for sale to programmes, government agencies, non-governmental organisations (NGOs), schools, colleges, fellow farmers and individuals. CDTNA shows how the establishment of a forest and farm producer organisation (FFPO) can transform scattered individual nursery producers into a much larger and more commercially successful enterprise development model with increased membership, varying skill sets and by promoting the inclusion of both men and women. A membership mix of newer and older members also creates a competitive environment for growth because it provides inspiration, interest, drive and motivation for new members to do better.

Through its organisation and networks, CDTNA has facilitated capacity development for and among its members. CDTNA is also involved in various networks to support its work. For example, technical knowledge has been shared by technical experts from the forestry, agricultural and environmental sectors. Farmer-to-farmer education programmes, field exchanges and field tours has also facilitated the transfer of skills and knowledge between members. FAO (through its FFF programme) also networks these farmers into its food and energy security programme, where farmers are trained to raise and maintain forest stock for many different purposes. CDTNA has also helped to transform some individual growers into smallholder group enterprises, creating new employment opportunities for youth and single parents and helping groups to develop and take advantage of opportunities and networks.

For the future, CDTNA aims to:

- Acquire its own land so that it can trade and operate independently.
- Broaden its fundraising to improve its overall governance.
- Hold regular meetings so that members can agree a collective business strategy.
- Seek funding to procure solar-powered pumps and an additional water storage tank as currently, the water supply is inadequate.
- Develop greenhouse facilities to provide controlled environments for applying pesticides and fungicides and to provide a quarantined environment for sensitive species.
- Seek additional government support via the Farmers Input Support Programme (FISP).

The research for this case study has also made some recommendations for improvements:

- The overall governance of CDTNA needs to be strengthened and the CDTNA constitution updated to address emergent issues. For example, new membership categories are required for group enterprises so that appropriate fees are charged and costs more equitably shared so as not to unfairly penalise smaller-scale individual members.
- CDTNA needs to improve its members' collective bargaining. Currently, buyers are forced to approach individual sellers which defeats the purpose of running a bulking centre.
- Although CDTNA has made deliberate efforts to encourage the better representation of women in the association, there is still an excessive proportion of men on both the executive committee and within the general membership. CDTNA should devise a membership drive that aims to recruit more women.
- CDTNA currently relies on a small pool of commercial clients, which is preventing its members' businesses from expanding. The associate can increase its income streams through increased marketing and advertising to expand its networks beyond its current clients. This will also open new markets.
- To diversify the number of species grown, CDTNA should conduct more market research and source additional training on how to cultivate different plants.

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## Acronyms

AGM	Annual general meeting
BICC-CDP	Brethren In Christ Church - Choma Development Programme
CAZ	Cotton Association of Zambia
CBO	Community-based organisation
CDTNA	Choma District Tree Nurseries Association
CRS	Catholic Relief Services
FAO	Food and Agriculture Organization of the United Nations
FD	Forestry Department
FFF	Forest and Farm Facility
FFPOs	Forest and farm producer organisations
FISP	Farmer Input Support Programme
IIED	International Institute for Environment and Development
ITK	Indigenous Technical Knowledge
MAL	Ministry of Agriculture and Livestock
NGO	Non-governmental organisation
NACRO	New Apostolic Church Relief Organisation
SNV	Netherlands Development Organisation
ZMK	Zambia kwacha (currency)
ZNFU	Zambia National Farmers Union



## 1 Introduction to CDTNA and its land-use impacts

This case study describes the Choma District Tree Nurseries Association (CDTNA). The association is unusual in that it focuses on the supply of inputs (planting materials) for agroforestry, rather than production from any particular forest or farm producer organisations. The research for this case study was based on questionnaire interviews with a sample group of members, including 10 men and six women growers, focus group discussions, and interviews with key informants such as personnel from the Choma Forestry Department, the Zambia National Farmers Union (ZNFU) and its affiliate the Cotton Association of Zambia, and CDTNA executive committee members.

### 1.1 About CDTNA

CDTNA was first formed in 2017 to promote the economic, social, cultural and environmental needs and aspirations of its members and their communities within and around Choma district. It is an affiliate member of the Farm Forestry Smallholder Producers Association of Kenya (FF-SPAK) and one of several forest and farm producer organisations (FFPOs) supported by the Food and Agriculture Organization of the United Nations (FAO) Forest and Farm Facility (FFF).

CDTNA is membership organisation registered under the Registrar of Societies in accordance with the Registrar of Societies Act Chapter 119 of the laws of Zambia. Preparation for registration dates go back to 2017 but actual registration and commencement of groundwork was registered sometime in 2019 (CDTNA undated). CDTNA is located in Choma district, Southern Province, at approximately 1400m above sea level. It is situated on the premises of the Choma Forestry Department district office in the timber yard. According to its constitution (CDNTA, Undated), CDTNA's stated mission is:

*To promote forest cover through raising tree seedlings for woodlot establishment from nurseries in Choma district.*

To achieve this, adheres to the following objectives:

- Facilitating trading and supplying to its members, and the general public, all kinds of tree and flower species (including Indigenous and exotic tree and flower species)
- Providing necessary and appropriate information, education and training to the association's members
- Conducting and participating in any shows and fairs in the district and in the province, and
- Obtaining and supplying to its members all necessary tree requirements and opening retail outlets for the sale of high-quality tree nursery produce.

While CDTNA does not use the term 'agrobiodiversity' in its objectives, the association is a key player in promoting and supplying and sharing both planting materials and knowledge to support on-farm agrobiodiversity.

### 1.2 Membership

CDTNA is a membership association whose members voluntarily seek to address their socioeconomic and cultural needs within a democratically elected and controlled enterprise. There was no indication of any permanent membership drive initiatives undertaken by CDTNA other than one radio advert. Affiliation came through a combination of the interests of members and the observed economic gains made by established members of the CDTNA business initiative. Most members maintain their nurseries at the Forestry Department premises, except for members located in distant areas who have plots on their own land. Several members interviewed were related family members.

The association has an executive committee comprising of 12 members, of whom five are women. The chairperson is Ms Veronica Mwemba. Current records register a total of 111 members (see Table 1). The table also indicates the number of members from specific localities or compounds (except those from an affiliated youth group). All members, including those within the youth group, are treated on an individual basis (not by area or affiliation).

**Table 1. Membership numbers and origin by area or affiliation**

Where members are from	Number	%
Chipande	15	13.5
Sibanyati	12	11
Oasis	10	9
Mapanza	12	11
Cow Young	14	12.5
Batoka	8	7
African Youth Global Network	40	36
<b>Total</b>	<b>111</b>	<b>100</b>

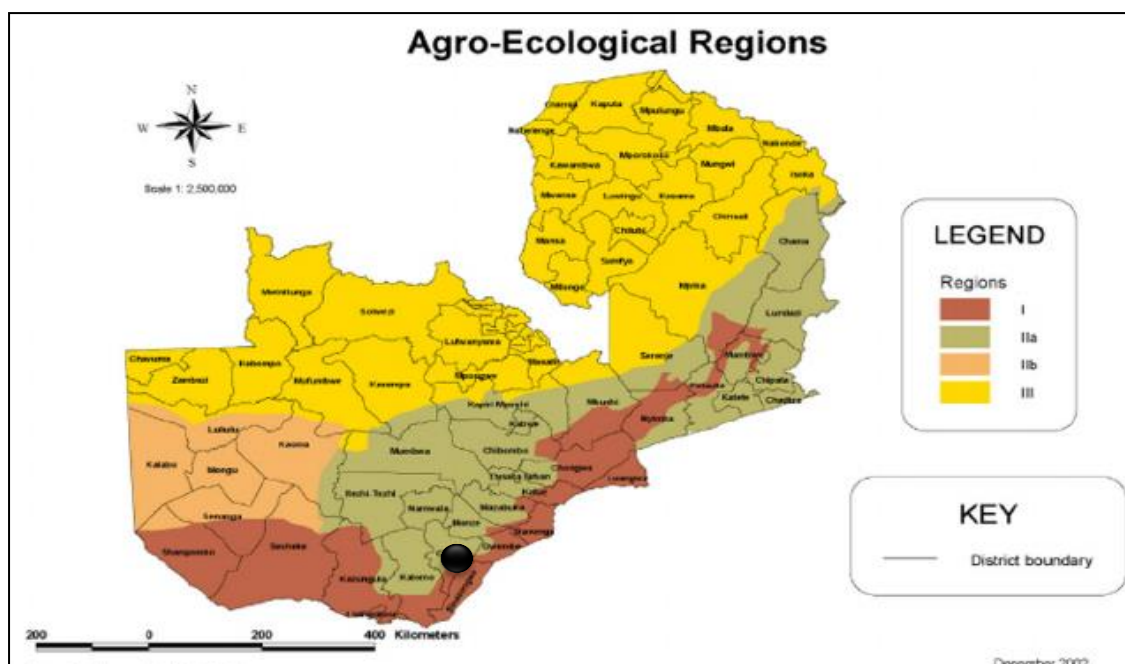
At the time of the study, there were about 40 women members, representing 36% of the total membership. The African Youth Global Network is an integral youth group affiliated to CDTNA comprising of 40 members, of whom 11 are women, representing 28%. The entire membership is located within the proximity of the Choma district Forestry Department timber yard with a few members living on the outskirts, such as in Batoka.

### 1.3 Land-use patterns

CDTNA supplies its tree seedlings to be planted in a largely agricultural landscape – and understanding this context allows the impacts of CDTNA to be seen. Agriculture forms the economic mainstay that drives the economy of Choma district and most people are involved in rural agriculture (Jere 2018).

The Central Statistics Office (CSO 2012) approximates the overall number of agricultural households for Choma district to be around 165,500, of which approximately 142,660 are men-headed households and 22,930 women-headed households. The district receives low to medium rainfall of 600–800mm per year, and temperatures range from 14°C to 28°C. Choma falls in between Agroecological Zones I and IIa (see Figure 1). Farmers use ox-drawn equipment and implements for transport and agriculture (Chisanga 2019). In the centre of the province lies the Southern Plateau, the largest area of commercial farmland of any Zambian province, producing most of the country's maize (Cordaro 2019).

While the zone is suited to diverse agricultural production, rainfall variations are experienced every season that have led consequently to variable crop yields in the district (Baudron *et al.* 2007). Droughts have increased people's vulnerabilities and it is estimated that 192,000 people in Southern Province have faced different sorts of food security crises (FAO 2018). Trees with products that can be sold to diversify income generation, or that can be used to improve soil fertility and yields, are consequently in high demand.

**Figure 1. Map of Zambia showing the location of Choma district (black dot)**

*Adapted from Adoption and intensity of adoption of conservation (2014)*

The Tonga residents of the area belong to the Bantu-speaking people and are predominantly subsistence farmers growing millet, maize, sorghum, cassava and pumpkins. Chickens, small ruminants and cattle are also kept for meat. Since they are also pastoralists, they use cattle for prestige, farming and transport, using ox-drawn carts. Cattle have been used for all forms of agricultural work in villages. Because of this, agricultural fields have often had stumps removed to facilitate the movement of cattle drawing ploughs and rippers, which is why the Southern Province has high levels of deforestation. However, this has also opened up a market opportunity for tree sales.

Zambian farmers are primarily subsistence smallholders – locally understood to mean they cultivate less than 5 hectares, are dependent primarily on family labour, use unsophisticated farming technology, purchase and use of very few farming inputs, and consume most of their produce. Farms are dominated by maize that is grown by 80% of those households (Phiri 2017). Since these smallholder production systems are mainly rain fed, changing precipitation has resulted in vulnerability and low yields (Cordaro 2019).

Smallholders often leave scattered and isolated low- or high-value trees on farms for shade, food and energy requirements. Since agroforestry is perceived to improve yields, some local people have culturally adopted this practice. Care and responsibility for the environment by local people has always been commonplace and are part of a set of local bylaws upheld by local traditional authorities under a very strict code of values and beliefs. Breaking those rules in such a way as to damage the environment for future generations would result in punitive action from the gods or spirits responsible for the natural resource in question (EEASAP 2002).

However, ecological principles built into shifting cultivation when land was plentiful and populations small have struggled to survive the growing demand for land (IDS 2006) and the incursion of fixed tenure regimes do not allow for adequate fallow (ZLA 2008). The increasing price of chemical fertilisers that once maintained yields in the absence of fallow has led to a search for biological fertilisers derived from more permanent ways of mixing crops and trees. New systems that favour agrobiodiversity have been promoted under names such as agroforestry, agroecology, climate-smart agriculture and/or conservation agriculture (Baudron *et al.* 2007; Chisha-Kasumu and Zulu 2016).

Despite the absence of a land audit, customary land in Zambia is said to constitute most of the land. Procedures for acquiring customary land are well known but often undocumented, varying from district to district and province to province. In the Southern Province, land rights are held for a specific



period of time and are bestowed by the headman, but where an owner is absent, land maybe given away to a new owner. This creatives insecurity of tenure, which is a potential disincentive for longer-term investment in tree growing. Nevertheless, cultivating the same piece of land through better use of agrobiodiversity is increasingly seen as the way forward – both sustaining yields and incomes, while also allowing for secure tenure. But where do farmers find out about, and get access to agroforestry planting material for more diverse farming systems? This is where tree nursery groups play such an important role.

## 2 Agrobiodiversity across the landscape

CDTNA's membership maintains a major set of nurseries within the premises of the Choma district's Forestry Department timber yard where they raise more than 338,000 of assorted seedlings at any one time categorised into more than 48 tree types and some genera have several species (see Table 3). The nursery is mainly for commercial purposes, raising seedlings for sale to programmes, government agencies, non-governmental organisations (NGOs), schools, colleges, fellow farmers and individuals. Excess and over-grown seedlings are sometimes left to grow on the site for shading and tree-seed multiplication, but often are simply planted out by smallholder members or their friends and families in a woodlot and/or as scattered and isolated trees.

Based on the sample of farmers surveyed for this case study, eight major buyers of seedlings were noted (see Table 2). These include the Netherlands Development Organisation (SNV), local schools, Plant a Million (a Zambian tree-planting initiative), Brethren in Christ Church - Choma Development Programme (BICC-CDP), New Apostolic Church Relief Organisation (NACRO), Catholic Relief Services (CRS), individual farmers and colleges.

**Table 2. Main customers of the CDTNA nursery members**

Main buyers	% of seedling sales	Ranking
BICC-CDP	7.5	4
Colleges	2.5	
CRS	5.0	
Individuals	2.5	
NACRO	7.5	4
Plant a Million	10.0	3
Schools	17.5	2
SNV	47.5	1
<b>Total</b>	<b>100</b>	

SNV was identified as the major buyer because of its active involvement in tree-planting programmes. SNV works with farmers, schools and villages where it supports agroforestry for food security and biofuels, which is the reason why CDTNA grows jatropha (a low-cost biofuel feedstock) specifically for this market. Schools and colleges also have active and ambitious tree-planting activities. Their seedling requirements are in part met by SNV, Plant a Million, NACRO, BICC-CDP but they also purchase substantial numbers of trees themselves from CDTNA. Plant a Million is also active in Choma. Its focus is on afforestation where it is heavily concerned with agroforestry, village tree banks and climate change activities and it conducts tree planting activities with villages and community schools. Plant a Million also encourages the growing of ornamental trees for decorative purposes such as flamboyant and jacaranda. The activities of the NACRO and BICC-CDP are also similar to that of SNV and Plant a Million but less substantial in terms of scale.

A summary of the species raised include fruit trees for food security and nitrogen-fixing trees such as gliricidia, leucaena, neem, jatropha and moringa for land stabilisation and use in agroforestry systems. Others species include trees for timber and fuelwood such as eucalyptus, pine, khaya, trichilea and mahogany. Ornamentals such as monkey puzzle, flowers, flamboyant and jacaranda are also grown. Tree species and their uses are given in Table 3.

**Table 3. The main tree and plant varieties produced by CDTNA and their uses**

#	Varieties	Main uses
1	<i>Lemon</i>	Firewood (twigs, dead branches), food (fruit, jam, pickles), drinks, flavouring (peel), medicine (juice, peel, roots, leaves), ornamental
2	<i>Leucaena</i>	Firewood, fodder (leaves, shoots), bee forage, ornamental, soil improvement, nitrogen fixing
3	<i>Gliricidia sepium</i>	Firewood, charcoal, posts, fodder (leaves, shoots, pods), bee forage, ornamental, mulch, green manure, nitrogen fixing, soil conservation, living fences, living stakes
4	<i>Eucalyptus</i>	Firewood, charcoal, timber, poles, bee forage, ornamental, windbreak
5	<i>Oranges</i>	Food (fruit), juice (fruit)
6	<i>Pine (xmas tree)</i>	Firewood, charcoal, timber, poles, resin (bark)
7	<i>Palm tree</i>	Rafters, poles, fruit, mats (leaves), baskets (leaves), string (fibres)
8	<i>Moringa</i>	Food (young pods, young leaves, flowers), fodder (leaves, young fruit), bee forage, soil conservation, water purification (seeds), ornamental, living fences
9	<i>Avocado</i>	Food (fruit), shade, cosmetics, oil (fruit)
10	<i>Guava (white/red)</i>	Firewood, timber (tool handles), fence posts, food (fruit, jam, jelly, juice), medicine (bark, leaves, roots), shade
11	<i>Loquat</i>	Food and health
12	<i>Khaya (mahogany)</i>	Firewood, timber (quality furniture), medicine (bark), bee forage, shade
13	<i>Trichilea</i>	Firewood, timber (furniture, tool handles, boats), poles, medicine (leaves, bark, oil), shade, ornamental, windbreak, oil, soap, cosmetics (seed)
14	<i>Tamarindus</i>	Firewood, charcoal, timber (furniture, boats, general purpose), poles, food (fruit, pulp for drink, spice), medicine (bark, leaves, roots, fruit), fodder (leaves, fruit), bee forage
15	<i>Granadilla</i>	Fruit, medicine, fencing, land stabilisation
16	<i>Apples (rose, casturd)</i>	Food, medicine and health
17	<i>Msangu/acacia</i>	Firewood, charcoal, timber (construction, canoes, utensils), posts, medicine (bark), fodder (pods and leaves), shade, mulch, nitrogen fixing, soil conservation/improvement
18	<i>Nichies</i>	Fruit, medicine, cosmetics
19	<i>Neem</i>	Food and health
20	<i>Uapaca spp</i>	Firewood, charcoal, timber (general purpose), poles, food (fruit, drinks), medicine (roots, bark, leaves), fodder (leaves, fruit), bee forage, shade
21	<i>Pawpaw</i>	Food (fruit), drinks (fruit), medicine (roots, leaves), meat tenderising (leaves, fruit)
22	<i>Sombo</i>	Fruit, medicine, cosmetics
23	<i>Cashew nut</i>	Fruit, medicine, cosmetics
24	<i>Candle tree</i>	Ornamental
25	<i>Grape vines</i>	Fruit, medicine
26	<i>Jackfruit</i>	Fruit
27	<i>Flamboyant</i>	Ornamental
28	<i>Peaches</i>	Fruit, medicine, cosmetics
29	<i>Jacaranda</i>	Timber, poles, bee forage, ornamental, windbreak
30	<i>Pomegranate</i>	Fruit, medicine
31	<i>Strawberries</i>	Food, ornamental
32	<i>Thuya</i>	Timber, poles, ornamental, shade
33	<i>Umbrella</i>	Timber, poles, bee forage, ornamental, windbreak
34	<i>Adansonia</i>	Food (shoots, leaves, fruit), drinks (seed pulp), medicine (roots, bark), fodder (leaves, fruits), bee forage, string/rope (fibres), gum, resin, dye (roots)
35	<i>Diospyros</i>	Timber, poles, bee forage, ornamental, windbreak
36	<i>Aloe spp</i>	Medicine
37	<i>Assorted flowers</i>	Ornamental
38	<i>Cactus</i>	Fruit, medicine
39	<i>Ficus spp</i>	Timber (carving), food (fruit), medicine (latex, leaves, roots, bark), fodder (leaves, fruit), soil improvement, dye (bark), gum (latex)
40	<i>Gmelina arborea</i>	Firewood, charcoal, timber (furniture, tools), poles, fodder (leaves, fruit), bee forage, shade, ornamental, windbreak
41	<i>Grape lime</i>	Fruit, medicine, cosmetics
42	<i>Jatropha spp</i>	Food
43	<i>Magwilinti</i>	Food (young pods, young leaves, flowers) fodder (leaves, young fruit), bee forage, soil conservation, water purification (seeds), ornamental, living fences
44	<i>Mango</i>	Firewood, food (fruit), medicine (leaves), fodder (leaves), bee forage, shade, ornamental, windbreak
45	<i>Monkey puzzle</i>	

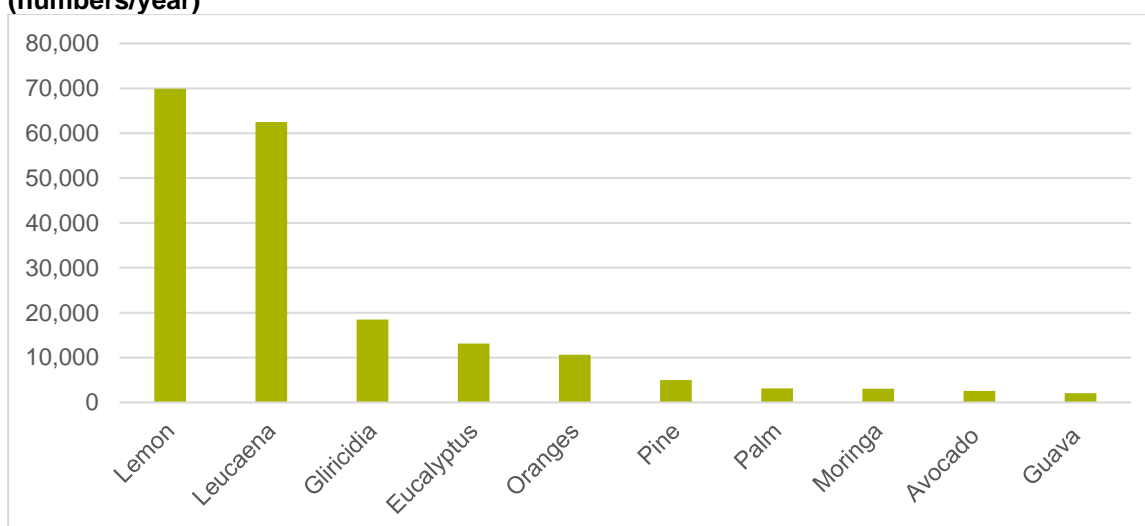
46	<i>Pigeon pea</i>	Food (seeds and leaves), fodder (leaves and pods), bee forage, windbreak, nitrogen fixing, soil improvement/conservation
47	<i>Syzygium spp</i>	Timber (construction, furniture), food (fruit), medicine (leaves, bark, roots), bee forage, dye (bark)
48	<i>Ziziphus</i>	Firewood, charcoal, timber (tool handles, handicrafts), fence posts, food (fruit), medicine (roots, leaves), fodder (leaves, fruit), bee forage, living fences

Anecdotal evidence suggests that local people are very sceptical about investing in traditional land even though this is the most common land-tenure system available in these areas. According to a Zambia Land Alliance report, most people in the Southern Province believe that land-tenure security is almost non-existent based upon the absence of land titles and because ownership can be easily transferred to a new owner (Chileshe *et al.* 2017). This is a key concern according to CDTNA’s acting chairperson, who is working to address this. However, some farmers opt to overcome land-tenure insecurity both by ensuring their prolonged use of the land and/or by investing in tree planting and home construction. The aim is that by showing they have increased their investment in the land, they may have a stronger argument to secure their tenure.

### 2.1 Species grown by men nursery owners

Interviews with six male nursery producers allowed the authors to tabulate the main species sold by numbers of seedlings per year (Figure 2).

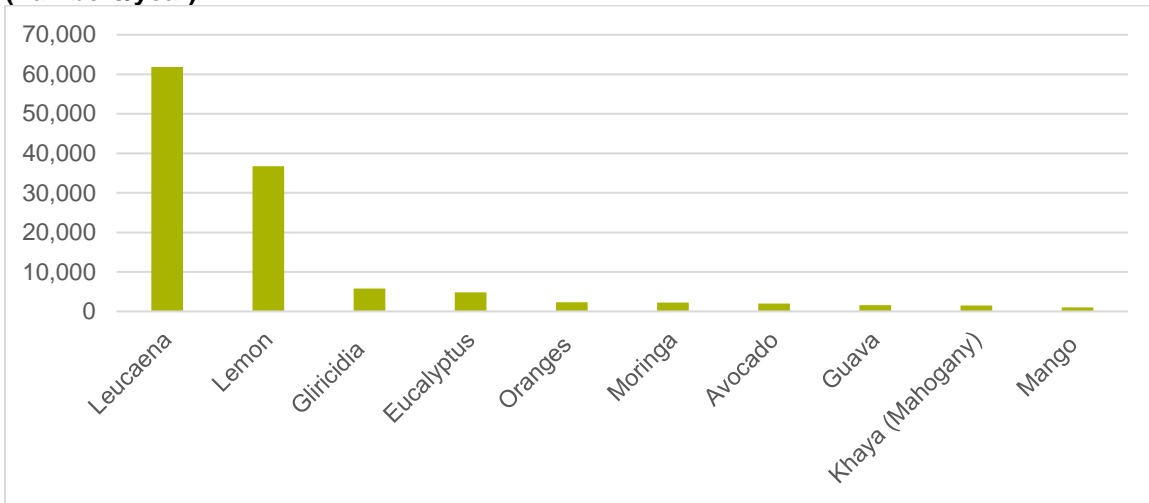
**Figure 2. Main types of tree seedling sold by the six men nursery owners surveyed (numbers/year)**



### 2.2 Species grown by women nursery owners

Similar interviews were conducted with 10 women nursery owners for this case study. The main species sold (by numbers of seedlings per year) is shown in Figure 3. It is important to note that the number and size of nurseries owned by women varies and so does not allow a like-for-like comparison with the results from the survey of men nursery owners.

**Figure 3. Main types of tree seedling sold by the 10 women nursery owners surveyed (numbers/year)**



The main five seedling species grown by both men and women nursery owners when arranged in a logical sequence look similar. But closer observation reveals that women raise more species for food security such as moringa, guava, avocado and mango. Men nursery growers on the other hand raise more commercial species such as pine and palm.



Nursery production at the CDTNA site at the Choma Forestry Department timber yard © Ernest Chingaipe

### 2.3. About the tree seedlings produced by CDTNA

The comprehensive list presented in Table 3 of tree nursery species and their uses was generated based upon the responses and observations made while on site during the research. It is clear that trees are sold for a wide range of end purposes, including for firewood, fruit, fruit juice, timber, poles, fodder, soil improvement through nitrogen fixing, charcoal, ornamental purposes, medicine, pesticides, bee forage, string, windbreaks, land stabilisation, tannins, cosmetics and fencing (Storrs 1995; Palgrave 2005; Center for Agroforestry 2018).



From the interviews, the seeds of most if not all species are collected locally. Collecting local seeds is seen as being advantageous because:

- Local seed eliminates uncertainties around the need to test germination and growth because seed collected in the area must be tolerant of the climatic conditions.
- Local seed reflects the existing preferences of the farmers. Farmers have strong requirements for income and planting trees involves trade-offs. For example, planting trees such as leucaena can be used to improve soil fertility, but they must compete in terms of the time and labour required to plant and tend them with alternative fertilisers such as using cow manure, which increases both soil fertility and drainage while at the same time eliminating cost of disposing on-farm manure (Center for Agroforestry 2018).
- Other positive feedback includes the fact that the more trees that are collected and planted locally, the greater the source and the cheaper it is to collect. Leaf fall also leads to soil improvement through bioaccumulation, which ultimately improves soil fertility, soil drainage and soil microfauna (Young 1988).

### 3 Knowledge sources for diverse tree crops

#### 3.1 Biocultural heritage around agrobiodiversity

Many nursery growers live traditional lives on smallholder farms. That lifestyle allows regular interactions where the older generation (grandparents, parents, uncles and aunts) teach the younger generation about important crops to grow which are well suited to the province. At farm level, such crops include millet, maize, sorghum, cassava and pumpkins.



Women nursery staff potting up tree seedlings © Ernest Chingaipe

Knowledge about how to grow different trees is also often embedded in African traditional life systems. In the absence of formal education, Africans value Indigenous Technical Knowledge (ITK). ITK is a traditional science of sorts that thrives on the use of traditional beliefs and values and thus embeds itself in traditional lifestyles. ITK is intergenerational and in the past, has been passed on through interactions between the old and the young.

ITK guides and shapes behaviour. For example, trees around homesteads are protected and not removed. Medicinal trees, nitrogen-fixing trees and fruit trees are often treated as sacred because of myths and folklore and are therefore protected. These beliefs, myths and folklore are then handed down to younger generations during non-formal interactions in the family and beyond. The combination of ITK and science-based information acquired from training and meetings with the Forestry Department, Zambia National Farmers Union (ZNFU) and FAO ensures that the knowledge base and practice of growing trees remains intact and is embedded in everyday life (EEASAP 2002).

Some of the trees grown are known from nursery tree growers' own experiences, which is why some of the seedlings raised such as sisal (used to make living fencing and rope), baobab and aloe are not easy to price. To sell these, nursery owners need to conduct market research to see how to price this stock competitively (ACCA 2000).

### 3.2 Knowledge transfer between nursery members

During this research, it was noted that many CDTNA members as smallholder farmers are also clustered in some kind of family unit. Some involve nuclear family ties while others are from extended family systems. Such family networks were said to be beneficial during training and information sharing.

Because the nursery provides a central point where CDTNA members congregate together, there is ample scope for knowledge sharing between individuals with different skills and experiences. While researching this case study, a classification system for nursery growers became apparent. New members (members who have joined since 2020) were referred to as 'unskilled'. Members who joined between 2019 and 2020 were referred to as 'semi-skilled', while those who had been members from 2017 to 2019 were referred to as 'extremely skilled'. Extremely skilled members were regarded as a good source of information about new business, sharing their knowledge and market contacts with other members.

This interaction has helped members to build confidence and develop their skills. It also acts as a motivation factor and provides in effect in-situ training and a learning environment where the transfer of knowledge happens. Relevant information regarding seedlings, cost and markets are frequently shared between fellow members. Through networking with other farmers, overgrown seedlings from the CDTNA nursery are also planted out on communal farm lands for the purposes of land stabilisation, nutrient fixing and ultimately land reclamation. The scattered tree method of planting usually adopted by CDTNA members in both communal areas and on their own farms is a key for encouraging agroecology at farm level. The more-knowledgeable CDTNA farmers' plots provide a showcase for neighbouring farmers who can easily replicate the design and start to incorporate more types of diverse trees on their farms.

### 3.3 FFPO knowledge networks that enhance agrobiodiversity

Interviews revealed that CDTNA members had also acquired knowledge about tree cultivation and management procedures from a number of different sources that had increased as CDTNA expanded its presence and networks. These include the Forestry Department, the Cotton Association of Zambia (CAZ), the ZNFU contact person, SNV and other partners of CDTNA.

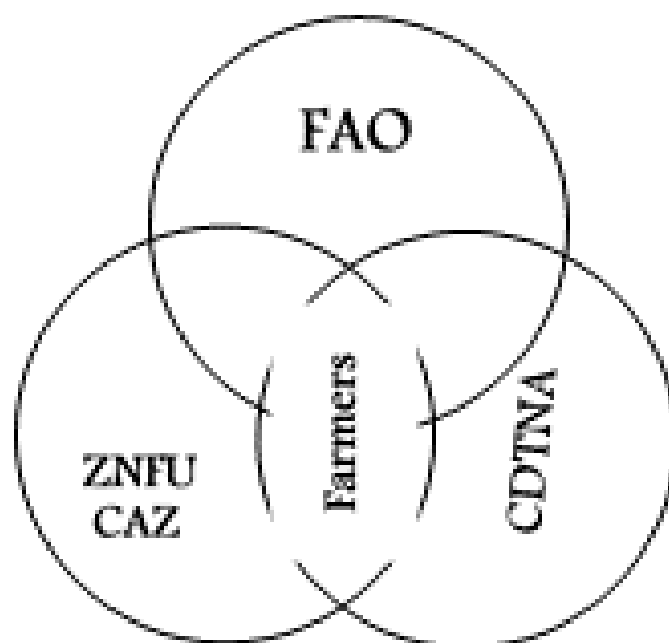
Information is shared at many different levels. Technical knowledge (such as tree parent stock identification, seed collection and storage, pot filling, sowing and climate-smart agriculture) has been shared by technical experts from the forestry, agricultural and environmental sectors. This has resulted in growers ensuring that seed is collected from healthy parent trees, that seed is good quality and has a very high germination potential. Information on storage, pre-treatment and sowing protocols have also been shared by the Forestry Department.

It was also observed that there was a lot of interaction between the companies, programmes and individuals that bought seedlings with CDTNA. This interaction was a means by which valuable information was exchanged about tree species to be raised and the numbers required. Generally, the nursery tree growers grow trees in anticipation of sales. For example, a lot of trees are grown in anticipation of sales to SNV, Plant a Million and other, which is why the greatest number of trees raised were leguminous (in line with the agroforestry programmes of those buyers).

Other methods of CDTNA teaching and learning include farmer-to-farmer education programmes, field exchanges and field tours. All of these take place in a small area the size of a backyard as farmers visit other fellow farmers on demonstration sites. This has also facilitated skills and knowledge transfer.

Another knowledge networking strategy observed was that of the interaction among ZNFU/CAZ, FAO and CDTNA, where the common intersecting factor for these stakeholders are the farmers themselves (see Figure 4). CDTNA was observed to play a pivotal role, acting as a hub and coordinating interaction between and other key players. CDTNA also provides training opportunities for its members when funds are available, attended also by representatives from the Forestry Department, the Ministry of Agriculture and Livestock. Notable trainings to date have covered climate change mitigation, nursery management and tree identification.

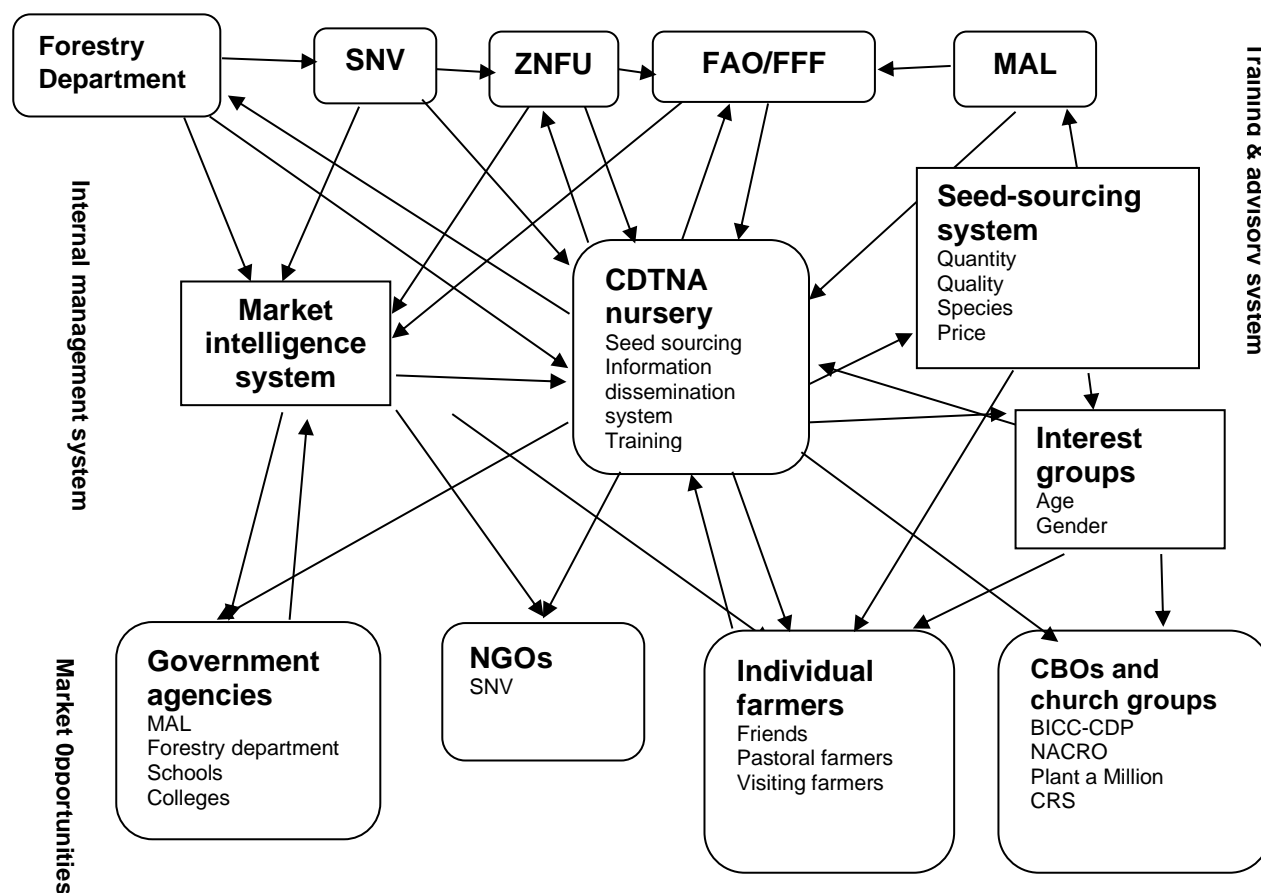
**Figure 4. Interaction between CDTNA, ZNFU, CAZ, FAO and farmers**



At household level, CDTNA members practice subsistence farming at their homesteads and are thus affiliated to ZNFU's CAZ programme. CDTNA members are aggregated by CAZ into study groups of 6–17 members where they are oriented on the use of self-taught study cycle materials produced by We-Effect (an international organisation working to end poverty). Study materials cover topics such as basic income generation and savings (village banking), cash-crop growing, cattle rearing and sustainable charcoal production.

FAO (through its FFF programme) also networks these farmers into its food and energy security programme, where farmers are trained to raise and maintain forest stock for many different purposes. The key trainer involved in this programme is the Zambian Forestry Department. It was also noted that CDTNA was coordinating and maintaining a lot of networking activities as well as its membership. Other networks include those focusing on training, markets, and information generation and dissemination (de Klerk 2010). These activities are shown in Figure 5, with a description of each of three knowledge systems below.

Figure 5. Diagram showing the complex networks managed by CDTNA



### 3.3.1 Training and advisory system

This network is comprised of organisations that offer information, training and advisory services to CDTNA, such as:

- Forestry Department: Responsible for training, and seed sourcing and quality control
- SNV: Responsible for providing valuable inputs about market information, seed sourcing and quality control, and training
- ZNFU: Responsible for training and aggregating farmer groups into study groups
- FAO/FFPOs: Responsible for both community and local radio programmes on training and for information dissemination
- Ministry of Agriculture and Livestock: Responsible for providing seed propagation information, seed distribution and training.

### 3.3.2 Internal management system

CDTNA’s internal management works like a market intelligence system where all members – old and new – can interact through localised training, information dissemination and quality control. The system is also responsible for updating members on market information and current market trends as well as possible areas for improvement (Jere 2018). It is combined with a seed-sourcing system that includes quality control and provenance testing. Interest groups have also been set up that allow individuals to share information about specific issues – or link up with others from similar families, gender, age and geographical area.

### 3.3.3 Market opportunities system

CDTNA uses its market opportunities system to identify markets that are in line with its objectives. CDTNA scans the market for both environmental and company marketing opportunities. The



environmental opportunities are used to identify farmer support organisations as ZNFU, SNV, Plant a Million and the Ministry of Agriculture and Livestock. Using a marketing approach that looks at a mix of price, product, place and promotion, CDTNA is able to respond to market demands by providing high-quality seedlings in line with customer needs and satisfaction (see ACCA 2000).



Member of CDTNA with seedling © Ernest Chingaipa

## 4 Seed sources for tree crops cultivated

### 4.1 Self-provisioning and multiplication of seed

CDTNA members raise a diversity of species of nursery plants ranging from fruit trees and ornamentals to construction timber, shelterbelt species, land reclamation species and fuelwood species. Seed is primarily collected locally from the farms and homesteads of local members. Nursery members tend to gauge the type and numbers of seedlings they need to sow based on their estimates of what buyers would prefer – but the mechanisms by which this happens in practice are not entirely clear.



Most seed is procured locally by nursery members © Ernest Chingaibe

Interviews with key informants revealed that some of these species – especially those that were nitrogen fixing such as leucaena, gliricidia, neem and moringa, and almost all fruit trees – are propagated on smallholder farms and then planted in a scattered fashion. Trees that are suitable for planting on homesteads and around institutions and farms are those that provide valuable products or services, such as shade, fruit, seeds or beauty. They also plant trees that do not shed too much litter or are deep rooted such that they are less susceptible to wind damage (Simute *et al.* 1998).

### 4.2 Bartering for and purchasing seed

The purchase of and bartering for some seed and seedlings also occurs, especially fruit trees. For example, bartering for oranges was observed. Instead of sowing oranges, nursery tree farmers start the process by raising lemon trees instead, onto which oranges are then grafted. Orange fruit scions are bought through a barter system from Maleba. There was no clear indication of the actual price and quantity exchanged but what was clear was that there was a verbal understanding that the cost of orange tree scions could be offset with an undisclosed number of orange-grafted seedlings as payment.

### 4.3 Formal systems: FFPO stores and purchase systems

CDTNA members also use their networks to source seed. In an attempt to understand this, nursery producers were asked to describe how they procured seed of the five different categories of trees shown in Table 4. However, the segregation into these five broad categories does not adhere to any



formal classification protocols. It was merely adopted as an attempt to assist discussion and set examples of species that were acquired from elsewhere.

**Table 4. Categories of tree discussed in relation to origin of planting stock**

Indigenous	Fruit	Exotics	Ornamental	Nitrogen fixing
Loquat	Adansonia	Eucalyptus	Palm tree	Leucaena
Khaya (mahogany)	Lemon	Pine (xmas tree)	Candle tree	Gliricidia sepium
Trichilea	Avocado	Palm tree	Grapevines	Moringa
Tamarindus	Guava (white/red)	Neem	Flamboyant	Msangu/acacia
Msangu/acacia	Loquat	Pawpaw	Jacaranda	
Uapaca spp	Apples (rose, casturd)	Candle tree	Pomegranate	
Candle tree	Lychees	Flamboyant	Strawberries	
Adansonia	Pawpaw	Jacaranda	Thuya	
Diospyros	Grapevines	Pomegranate	Umbrella	
Aloe spp	Peaches	Thuya	Aloe spp	
Cactus	Grape lime	Umbrella	Assorted flowers	
Ficus spp	Mango	Jatropha spp	Cactus	
Syzygium spp	Ziziphus			
Ziziphus				

From discussions with the nursery tree growers, several factors became apparent:

- Indigenous tree species are sourced from Nyimba district and are bought as fruit at the Choma market. However, there was no discussion or mention of seed storage nor the provisions for storage on the CDTNA premises. If seeds are stored, it is for short periods and merely to facilitate seed pre-treatment in preparation for sowing.
- Fruit tree seeds of both citrus and Indigenous fruits were bought from the open market as fruit. After the fruit is eaten, the seeds are prepared and sown.
- High-value exotic seeds such as pine is bought from named farmers along the Livingstone Road at a cost of 2,000 Zambian kwacha/kg. Eucalyptus is bought from Sibanyati at 1,000 Zambian kwacha/kg. Meanwhile, ornamentals such as flamboyant were either acquired from healthy parent trees and/or bought from the Forestry Department. Thuya is acquired from a local supplier at the cost of 200 Zambian kwacha/kg (usually supplied in a 250g jam jar).
- Seed from nitrogen-fixing and ornamental trees are collected from either the nursery site itself, from houses around the nursery, and/or in and near smallholdings. Seeds for nitrogen-fixing trees are the most abundant and the easiest and cheapest to collect.
- Unlike newer members, older members are experienced nursery tree growers and are very particular about the type and quality of seed they sourced.

#### 4.4 Challenges in seed and seedling management

CDTNA has been operating since 2017 and it is clear that during the early years of operation, CDTNA may have been a market leader using this business model. From the information gathered, older members made a considerable amount of profit before membership swelled to the current 111+ members.

However, as CDTNA began increasing its operations (increasing the agrobiodiversity of what it sold and using training, meetings and radio programmes to improve its production processes) there was an influx of new members. Consequently, CDTNA must now increasingly differentiate what is sold by which members because of the levels of competition between members. This has resulted in a series of challenges. The results in Table 5 shows that members are struggling both to secure markets for their plants, but also to acquire the seed and other production components such as water and chemicals to maintain their growing stock.

**Table 5. Challenges reported by CDTNA members ranked by number of respondents**

<b>Challenge</b>	<b>Count</b>	<b>Ranking</b>
Limited information flows	2	
Meetings are limited to a selected few	2	
Establishing new member enterprises	1	
Markets for plants	12	1
Water shortages	12	1
Cost of pesticides/fumigants	6	3
Cost of polythene pots	7	2
Lack of nursery equipment	1	
Erratic electricity supply	2	
No government support	1	
Sourcing quality seed	6	3
Insecure premises (theft)	2	
Payments take too long from buyers	3	
Poor collective marketing	1	
Lack of adequate space	1	
Poor pricing of stock	1	
Shortage of soil for pot filling	1	

## 5 Enterprise strategies and agrobiodiversity

### 5.1 Commercial sales

Most if not all CDTNA members make a commercial income in two ways – firstly from the sale of seedlings, but also from farming on communal land:

- In terms of seedling sales, nursery producers are often grouped into enterprises that make their own sales, but often in coordination with the CDTNA leadership when there are large orders to fulfil. CDTNA uses a single commercial price list to harmonise sales between the different internal groupings and members sign up for the use of this price list.
- In terms of farming, the communal nature of their land tenure means that members must ensure that any land use is effective and efficient. Because of this, they grow crops that can provide a higher income, require lower rainfall and have a short maturation period, such as millet, sorghum, maize, soya, wheat, groundnut and sunflower. Other farmers are involved in animal husbandry where they rear cattle and small ruminants such as goats and chickens (Baudron *et al.* 2007).

### 5.2 Changing patterns of commercial sales

CDTNA is a collective business entity and therefore operates its tree nursery entirely as a commercial venture. All crops raised are sold for profit and not to be distributed for free. It was very clear from the respondents that all seedlings are raised to be sold, apart from seedlings that are too overgrown to sell (in which case they can be given away to individuals and neighbouring farmers). For this reason, CDTNA has developed a comprehensive price list that also serves as a governance tool:

- It informs CDTNA members about the most lucrative species on the market
- It guides CDTNA members by allowing them to project how much income they will raise from their sales of different species, thereby presenting a powerful tool for planning, and
- Based on collective agreement, it is a legally binding document.

### 5.3 Commercial income raised by men and women

Both men and women nursery growers generate income through seedling sales under the overall umbrella of the CDTNA. To assess the profitability of these activities, the research sought to understand how much each nursery grower member had invested in their business. However, it was difficult to derive any meaningful calculations based on the fact that stock records are rarely well kept. In addition, the amount of stock left over after a series of sales was unknown because growers replenish their stock on a daily basis through pot filling and sowing.

Tables 6 and 7 show the financial information on sales provided by both the men and women nursery producers interviewed for this case study. One woman nursery grower (Farmer 10) had 42,363 plants valued at 525,300 Zambian kwacha, while the Farmer 5 had only approximately 2,130 plants, valued at 23,250 Zambian kwacha.



**Table 6. Financial information on sales for surveyed women nursery producers**

Farmer	Year of affiliation	Total stock	Varieties	Diversity	Variety %	Value of stock (ZMK)	Sales 1 (ZMK)	Sales 2 (ZMK)	Sales 3 (ZMK)	Sales 4 (ZMK)	Sales 5 (ZMK)	Total sales (ZMK)
1	2017	7,250	10	52	19	66,790.00	7,000.00	3,500.00	2,500.00	1,500.00	3,200.00	17,700.00
2	2021	4,272	2	52	4	4,270.00	-	-	-	-	-	-
3	2019	9,060	11	52	21	109,850.00	2,080.00	2,000.00	-	-	-	4,080.00
4	2021	7,690	11	52	21	80,450.00	1,100.00	3,200.00	-	-	-	4,300.00
5	2021	2,130	4	52	8	23,250.00	5,800.00	-	-	-	-	5,800.00
6	2021	9,545	19	52	37	131,900.00	2,400.00	-	-	-	-	2,400.00
7	2017	31,457	12	52	23	397,815.00	10,600.00	9,000.00	10,000.00	-	-	29,600.00
8	2022	6,464	11	52	21	81,550.00	10,000.00	-	-	-	-	10,000.00
9	2021	11,321	16	52	31	118,591.00	5,100.00	-	-	-	-	5,100.00
10	2019	42,363	21	52	40	525,300.00	11,300.00	16,000.00	32,000.00	53,000.00	-	112,300.00

**Table 7. Financial information on sales for surveyed men nursery producers**

Farmer	Year of affiliation	Total stock	Varieties	Diversity	Variety %	Value of stock (ZMK)	Sales 1 (ZMK)	Sales 2 (ZMK)	Sales 3 (ZMK)	Sales 4 (ZMK)	Sales 5 (ZMK)	Total sales (ZMK)
1	2022	33,837	10	52	19	429,450.00	-	-	-	15,000.00	-	15,000.00
2	2020	11,978	10	52	19	113,960.00	-	-	-	1,050.00	6,055.00	7,105.00
3	2017	11,750	9	52	17	133,200.00	-	1,100.00	2,800.00	-	-	3,900.00
4	2019	32,200	12	52	23	513,500.00	-	-	-	10,000.00	-	10,000.00
5	2021	7,115	7	52	13	96,315.00	-	-	-	15,000.00	-	15,000.00
6	2017	122,849	29	52	56	1,653,485.00	-	-	-	-	250,000.00	250,000.00

However, tables 6 and 7 show that the value of stock held does not necessarily translate into actual profit. For example, one male nursery grower (Farmer 6) had 122,849 plants in stock valued at 1,653,485 Zambian kwacha but had only made 250,000 Zambian kwacha in sales. There are notable challenges associated with holding stock for such a long time:

- The longer nursery stock is left unsold, the less value it has in real terms due to accumulating and ongoing overhead costs (such as electricity, water, fertiliser, fumigation and pesticides).
- Significant sales only occur once a year and usually during the rainy season. Infrequent sales means that there is no correlation between the amount of money being invested and income being generated. This was identified as a problem by the nursery growers.
- The performance of older members was higher than for newer members (female farmers 1, 7 and 10, and male farmers 1, 4 and 6). Anecdotal evidence suggests a direct link between the duration of membership and market linkages. This was seen as a possible source of social conflict.

Even though a larger number of members raised particular species as compared to others, there was absolutely no direct linkage observed between the asking price of seedlings (based on pricelist) and numbers raised per species (in the nursery). It is not clear from any records which seedlings generate the most profit after nursery costs are deducted, but one might have expected to see higher numbers of oranges and msangu/acacia grown, as these were the most expensive seedling trees on the pricelist (fetching 50 Zambian kwacha/seedling for oranges and 70 Zambian kwacha/seedling for Msangu/Acacia). However, these seedlings were not ranked highly by either men or women growers. The men collectively grew 10,598 oranges and 400 msangu/acacia seedlings while the women grew only 2,270 oranges and 350 msangu/acacia seedlings. The low numbers for the production of oranges could be attributed to low demand, the lack of skilled labour (for grafting), the high costs of pesticides and fungicides, and probably issues related to arrangements for acquiring scions and having a limited market. At the time of this study, SNV was the only NGO promoting the growing of oranges on smallholdings.

#### 5.4 The role of CDTNA in shaping what is sold

CDTNA has been instrumental in shaping enterprise development. It has assisted in transforming individual growers into smallholder group enterprises, including:

- Royana Enterprises (6 growers)
- Rashid Siyuni Enterprises (1 grower)
- Maureen Enterprises (2 growers)
- Flonzu Company (2 growers), and
- Oasis Cow Young (4 growers).

Under the umbrella of CDTNA, these enterprises have created new employment opportunities for youth and single parents and has helped them to develop and take advantage of more business-oriented opportunities and networks. It was also noted that CDTNA depends on network building and in this respect, CDTNA has made tremendous strides.

## 5.5 Future plans

For the future, CDTNA aims to:

- Acquire its own land so that it can trade and operate independently and outside of the Forestry Department premises.
- Broaden its fundraising so that it can normalise its governance systems by holding regular annual general meetings (the last AGM was in 2017). An AGM is needed to amend its constitution.
- Hold regular meetings where members can interact more and agree a collective business strategy (see also recommendations in Section 7). Currently, membership interactions are achieved through donor-sponsored meetings, seminars and trainings held by partners and advisory bodies.
- Engage donors to assist with procurement of solar-powered pumps and an additional 10,000-litre water storage tank. Currently, the water supply is interrupted by load shedding and the 10,000-litre tank in use is inadequate to facilitate all nursery operations. This is affecting quality and stock diversity per farmer.
- Develop greenhouse facilities which can facilitate controlled environments for pesticide and fungicide application. This will also provide a quarantined environment for sensitive species such as oranges.
- Source new business. This may entail asking for additional government support so that the distribution of tree seeds is included alongside agricultural seed in the existing package of farmer support currently provided by the Farmers Input Support Programme (FISP).

## 6 Lessons learnt

### 6.1 Positive impacts

CDTNA provides an enabling business environment for raising, selling and planting a wide range of forestry and agroforestry species to diversify incomes and improve landscape management. It is a key player in promoting on-farm agrobiodiversity through the incorporation of tree species of different sorts in Choma and beyond. It is an umbrella body that provides its members with the support of a legal entity, market information, technical support and protection through a constitutionally elected committee with access to training support systems using an agrobiodiverse business development model.

CDTNA is an excellent example of how the establishment of a forest and farm producer organisation (FFPO) can transform scattered individual nursery producers into a much larger and more commercially successful enterprise development model with increased membership, varying skill sets and promoting the inclusion of both men and women.

Through its organisation and networks, CDTNA has facilitated capacity development for and among its members. Capacity development includes knowing what trees to cultivate, where to acquire good-quality seed, the location of healthy parent seed trees, and how to grow and sustain enterprises based around nursery seed sales.

The strategic and central location of the CDTNA seedling nursery within the Choma central business district both eliminates and/or transfers all costs of transportation and delivery to the client thus ensuring CDTNA members can make a considerable profit without the burden of delivery costs. This makes viable even the little incomes generated by these small-scale producers and goes a long way towards increasing morale among members.

Costs of activities such as seed selection, soil collection, transportation and fertiliser have been greatly reduced because seeds and soils are collected locally and sometimes within the premises, with biofertilisers such as leaf ash and compost made and collected locally, and animal manure located across the road and transported to the site by wheel barrow.

CDTNA's new business model is gaining momentum and this is evident through the following observations:

- There has been a rapid organisational transformation from CDTNA merely supporting individuals to now supporting company affiliates within its membership.
- There is an increased demand for quality seedlings. This was deduced from:
  - The increased need for irrigation water. The existing tank currently holds 10,000 litres and this is no longer enough to supply irrigation for all seedling growers so as to enable them respond to their clients' needs and demands
  - Numerous complaints received over the erratic electricity supply needed to pump water. The members want adequate water and power to support their plants and get them ready for market. Sales are determined by the quality, size and condition of plants but the lack of water and electricity is an issue.
- CDTNA's members' efforts are paying off in terms of landscape restoration. Choma has historically had high deforestation rates but tree seedlings that are being raised are rapidly being sold and/or stolen from CDTNA's premises. This is a direct indicator of a ready and insatiable market for CDTNA.
- The number of trees being bought from the CDTNA tree nursery through its various clients has generated marketing publicity at no cost to CDTNA. It has been shown that clients are publicising the CDTNA seed agrobiodiversity project and many more buyers are listening and watching as they conduct their tree planting.
- Lastly, CDTNA is making a very positive contribution to agrobiodiverse landscape restoration because the type of species being distributed and grown are contributing to land reclamation, fodder production, nitrogen pumping and fixing, and adequately addressing food security and energy needs (Storrs 1995; Simute *et al.* 1998; Palgrave 2005).

Engaging youth and single mothers as affiliate members is also a positive strategy for combating youth delinquency and prostitution (which are fuelled by unemployment). CDTNA is therefore helping to provide livelihoods and income for this young generation (FAO 2018). A membership mix of new and old members also creates a competitive environment for growth because it provides inspiration, interest, drive and motivation for new members to do better.

## 6.2 Negative impacts (deficiencies in governance)

At the time of study, there was a leadership crisis in CDTNA. The chair was ill and operations were being overseen by the vice chair. However, there were no plans for fresh elections or to fully develop a new business plan. In addition, CDTNA's current constitution is inadequate to deal with the current situation.

There was also evidence of self-defeating behaviour being practiced among members. Some members were withholding market information regarding species required, costs and technical operations. Another observation was that some members were neglecting to use the bulking centre to aggregate seedlings for collective bargaining. This comes at the expense of weaker members. This failure on the part of some members to share, protect and offer advice to other members over quality of stocks was seen as self-defeating in that this action would have an adverse effect on all members. Take for example a crop such as oranges, which cost 50 Zambian kwacha per plant. Some members would spray adequately to treat pests with the view of improving their stock to make better sales. However, due to their lack of experience, some others would not. Eventually, this could incur increased costs due to the need for repeat pesticide treatments for one party while the other would experience the loss of their crop entirely. This can be avoided.

There is a general failure by CDTNA to manage the nursery as a bulking centre to aggregate products to fulfil orders (an initial objective of the association). The bulking centre was intended to safeguard individual members when dealing with buyers. With this breakdown, influential buyers are now directly negotiating with individual members and ultimately exploiting them by driving down prices to as low as 3 Zambian kwacha (regardless of the species) and then paying after many months. Sticking to sales through a bulking centre would have prevented this as there was a collectively developed price list with clear payment guidelines.

Additional problems include:

- Recordkeeping is inaccurate and there is little regular information flow between and among members of CDTNA.
- Other than training and market information, there is no other link between the CDTNA and other government institutions.
- There is no deliberate marketing team to source for new business.
- The general absence of regular meetings and channels for disseminating information dampened individual morale. The last AGM was held in 2017 (five years ago).
- There are cost inequalities between members. Those with a high quantity of stock pay the same as those with a fraction of that stock. Each member pays 30 Zambian kwacha towards electricity to pump water into the tank and 100 Zambian kwacha for annual membership.



## 7 Conclusions and recommendations

The networking diagram in Section 3.3 (Figure 5) was created to analyse how networking affects CDTNA either positively and/or negatively before developing a gap analysis and solution-building matrix. This exercise culminated in a set of 11 recommendations for the future plans of CDTNA and are intended to build on what is positive and address some of the current challenges (Table 8).

**Table 8. Recommendations for improvements**

#	Current situation	Proposed remedial actions
1	There are notable issues regarding information flows to and between members (for example, about which species to plant, market sources and outlets, quality of seedlings and tending operations). There is also a need to build the capacity of association members in terms of collective bargaining. Currently, buyers are forced to approach individual sellers. This defeats the purpose of a bulking centre.	<p>The executive committee should hold regular information update meetings through:</p> <ul style="list-style-type: none"> <li>• Peer-to-peer learning</li> <li>• Learning from professionals</li> <li>• Learning from partnerships</li> <li>• Integrated training programmes</li> </ul> <p>There is also the need to provide periodical capacity-building sessions where members can share their experiences. These actions will reduce speculation and conflicts while increasing members' collective bargaining power.</p>
2	CDTNA's current constitution currently only allows for individual membership. However, some groups of founder members have now formed smallholder businesses. There is currently no category of business membership within CDTNA's constitution.	<p>There is need to amend the CDTNA constitution to address emergent issues such as:</p> <ul style="list-style-type: none"> <li>• Creating different membership categories</li> <li>• Defining the responsibilities and expectations of these member categories</li> <li>• Deciding appropriate fees to charge different membership categories</li> </ul>
3	Smallholder businesses are still only required to pay the same membership fee as individual growers (100 Zambian kwacha per year and 30 Zambian kwacha per monthly for water utility bills). This is irrespective of the quantity of seedlings being raised. The current flat rate is unfair to individual members who only have a few thousand seedlings.	<p>There is need to redistribute utility bills for water and electricity so that costs are equitably shared. A parameter that can be used for qualifying this is the number of seedlings being raised by each member (businesses and individuals).</p>
4	It was noted that knowledge, skills and experience in agriculture-related fields is notably beneficial to farmers. Farmers who have more knowledge, skills and experience are doing better than those who do not in terms of market access and the quality of seedlings they produce.	<p>The association should encourage and design study circles for capacity building and information sharing. CDTNA should link to WeEffect and adopt a deliberate policy of obtaining and sharing study circle training materials with its members, as these materials are already available locally.</p>
5	There were notable issues relating to poor governance within CDTNA concerning sharing marketing information, benefit distribution, number of members and meeting attendance.	<p>CDTNA should provide orientation training for executive committee members in good governance as well as resource mobilisation, allocation and distribution. More generally, CDTNA should integrate Free Prior and Informed Consent (FPIC) approaches and practices within CDTNA's dealings and activities.</p>

6	There is a worthwhile link between ZNFU and CDTNA but this has not been explored to its fullest.	CDTNA should generate a memorandum of understanding (MoU)/memorandum of collaboration (MoC) with the ZNFU's Cotton Association of Zambia to enhance its existing partnership.
7	Despite the fact that the CDTNA chair is a woman and deliberate efforts have been made to encourage the better representation of women in the association, there is still an excessive proportion of men compared to women on both the executive committee and within the general membership. This is a particular concern as food and energy security issues that CDTNA seeks to address are directly linked to women.	CDTNA should devise a membership drive that aims to recruit more women, for example by working with SNV and community and church-based organisations to attract new women members by promoting the benefits of joining at on-farm exhibitions, farmer-to-farmer learning activities, market days and other specific events that celebrate women (such as International Women's Day and Mother's Day).
8	CDTNA has declared that it will promote equity sharing and ensure the better distribution of revenues and supply contracts to women. However, male members are still benefitting more than women members.	<p>CDTNA should pursue and source new business with gender-focused organisations. This can be done with the view of strengthening gender mainstreaming in the agricultural and rural sectors.</p> <p>CDTNA should also emulate and upscale the actions of Chief Chooma, who donated five hectares of land to Eagle Women Zambia (EWZ) to help alleviate poverty for women.</p>
9	Only a handful of organisations currently purchase seedlings from the association. This is the main reason why CDTNA has limited income streams. In addition, most sales are made during the raining season rather than all year round.	<p>CDTNA should increase its income streams by upscaling marketing and advertising strategies that can sustain the business throughout the year.</p> <p>CDTNA should tap into the FISP programme and encourage the government to distribute leguminous trees seed, which farmers can then plant alongside their crops. This recommendation was also made by Chief Chooma during a tree-planting ceremony in Singani Chiefdom (Jere 2018).</p> <p>CDTNA should conduct farm audits and identify wasteland on farms for subsequent conversion into woodlots, orchards and plantations.</p>
10	Some of the members of the executive committee have other permanent official responsibilities with other organisations. This compromises the amount of time they can dedicate to executing the mandate of CDTNA.	CDTNA should consider engaging individuals with adequate time and the necessary commitment to serve the association fully. Ordinary members have felt let down by CDTNA, having sacrificed their life savings in pursuit of sustainable livelihoods, sustainable energy, food security and incomes – all of which are key attributes of practicing agrobiodiversity.
11	Members still heavily depend on advice from the clients as to which species they should grow.	CDTNA should expand its work to outside of its current network of clients to diversify the number of types of species grown. This will also open new markets. CDTNA should:

		<ul style="list-style-type: none"> <li>• Conduct market research about other potential species that could be produced and sold.</li> <li>• Source additional training to strengthen and formalise their advisory or marketing wings.</li> <li>• Source additional training on how to cultivate different plants This this will mean pursuing and forging new networks with botany departments to help research on useful native species.</li> </ul>
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