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Traditional Agroforestry Practice in Limpopo Province of South Africa

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ABSTRACT Agroforestry practices are widespread among resource-poor farmers in the Limpopo Province, yet information on this land use system is minimal. A general survey was undertaken through site visits and structured questionnaire to generate information on structure, components, management and socio-economic issues on the agrisilvicultural and agrisilvopastoral systems among the farmers in diverse agroecological zones of the province. The following annual rainfall distribution was used to classify specific agroforestry in the communities: very low (<500 mm), low (500-600), medium (601-800) and high (801-1000) annual rainfall. Results from the survey revealed that, tree and shrub species are retained on croplands for various reasons across rainfall zones. Major concerns on adopting agroforestry include the lack of land ownership to accommodate long term investment in trees, lack of knowledge and support on agroforestry, interference on annual crops by trees and livestock. Despite the challenges, most farmers interviewed have strong interest in intensive agroforestry systems.

INTRODUCTION

South Africa faces several challenges which extend to land degradation, low levels of productivity in rural communal areas and persistent rural poverty DAFF (2017). Unsustainable agriculture practices which bring about deforestation, desertification, and soil erosion are accelerating the reduction in land productivity particularly in the smallholder farming sector (Kelso and Jacobson 2011). Agroforestry (AF) has the potential to curb this rapid decrease in land productivity as well to reclaim already degraded lands (Kassie and Yildiz 2016; FAO 2017). The ability of AF to improve soil fertility, increase crop and livestock productivity, control erosion and reclaim degraded lands has been reported in many studies (Toppo and Raj 2018; Mbow et al. 2014; Siriri et al. 2013; Jose and Bardhan 2012). AF has so many benefits that range from environmental, economic and social benefits to address food insecurity in Africa.

Reports indicated that, per capita land for agriculture in Africa declined between 2000 and 2011 (FAO 2014). Furthermore, the average yields of grain crops in Africa is reported to be only 1.6 t ha^{-1}, compared to the global average of 3.9 t ha^{-1} (Tadele 2017). The low productivity in Africa is also related to poor soil fertility and scarce moisture, as well as a variety of insect pests, soil diseases, and weeds. Approximately 65 percent of arable land, 30 percent of grazing land and 20 percent of forests in Africa are al-

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ready damaged (Montpellier Report 2014). Reversing the trend of soil fertility depletion in African farming systems through soil conservation practices such as cover cropping, reduced tillage, crop rotation, mulching, and integrated soil fertility management is a major development goal to increase agricultural productivity (Ngumbi 2017).

Increase in mean annual temperatures by approximately 0.65°C has been reproted for South Africa over the past five decades (Matji 2015) which is about 1.5 times the global average.. There has also been an increase in the number of warmer days and a decrease in the number of cooler days. Furthermore, South Africa is a water scarce country with an estimated average rainfall of 450 mm per annum and a comparatively higher evaporation rates. The average annual rainfall is well below the world's average of 860 mm per annum (Benhin 2006; World Bank 2010).

In Limpopo Province in particular, water is a major limiting resource which often results in crop production losses and lower incomes in vulnerable areas. The adoption of agricultural production systems that are more productive, efficient in resource use, resilient to risks and have less variability but greater stability in their outputs is required if productivity in this farming system is to be maintained. Effective diversification of production through mixed cropping, mixed farming and agroforesety systems have been suggested as a feasible location specific strategy that can be adopted by resource-poor farmers to cope with climate change (FAO 2013).

In general, agroforestry occurs in diverse forms in South Africa. A review of several studies has shown that, leaving trees on farmlands as agroforestry is prevalent in most agricultural production systems (Garrity 2006; Akinnifesi et al. 2008; Safriel et al. 2014). Agroforestry is thus passive in the sense that farmers choose not to remove specific trees when clearing land for farming whilst others are deliberately cut. There are also by legislation, certain protected species such as Marula (*Sclerocarya birrea*) that are not to be removed, resulting in higher population of the species in areas where they occur. Some farmers interplant trees with other subsistence plants for a number of reasons which extend to food source, medicinal, water conservation, fodder production, generating enough material for fencing, building or fuelwood etc. (Kaboré and Reij 2004). Fruit trees are cherished to supplement the subsistence needs of local communities.

Traditional agroforestry practices provide added advantage of mitigating biodiversity loss, increase ecosystem services through carbon sequestration and thus, create opportunities for improving diversification and range of livelihood options for rural households (Bhagwat 2008; Toppo and Raj 2018). It has a huge potential in supporting biodiversity conservation. This study was initiated to document practises among resource-poor farmers in Limpopo province of South Africa that will provide the bases for future research, and community empowerment to increase crop and livestock productivity in the midst of climate change.

METHODOLOGY

Study Sites

The Limpopo Province (*formally Northern Province*) of South Africa lies roughly within latitudes 22° and 25° south of the equator and longitude 26.4 and 31.2. The province thus encompasses both tropical and sub-tropical climatic conditions which have definite influence on native vegetation and agricultural practices. During the year of survey (1999-2000), the province was divided into six administrative districts, namely: Northern, Western, Southern, Central, Eastern and Southveld districts. The respective current district names are: Vhembe, Waterberg, Greater Sekhukhune, Capricorn and Mopane. The Southveldt is no longer part of the Limpopo province. The annual rainfall ranges from <300 mm to >1000 mm (Fig. 1), with most parts being relatively dry with an annual rainfall of less than 600 mm. The rational for conducting the survey within the administrative regions was that, farming practices are generally more homogenous within a district compared to the province as a whole.

Data Collection

A general survey was undertaken from 1999 to 2000 to generate information on structure, components, management and socio-economic factors on agrisilvicultural and agrisilvopastoral systems among resource poor farmers in the diverse agroecological zones of the province. Information regarding traditional agroforestry

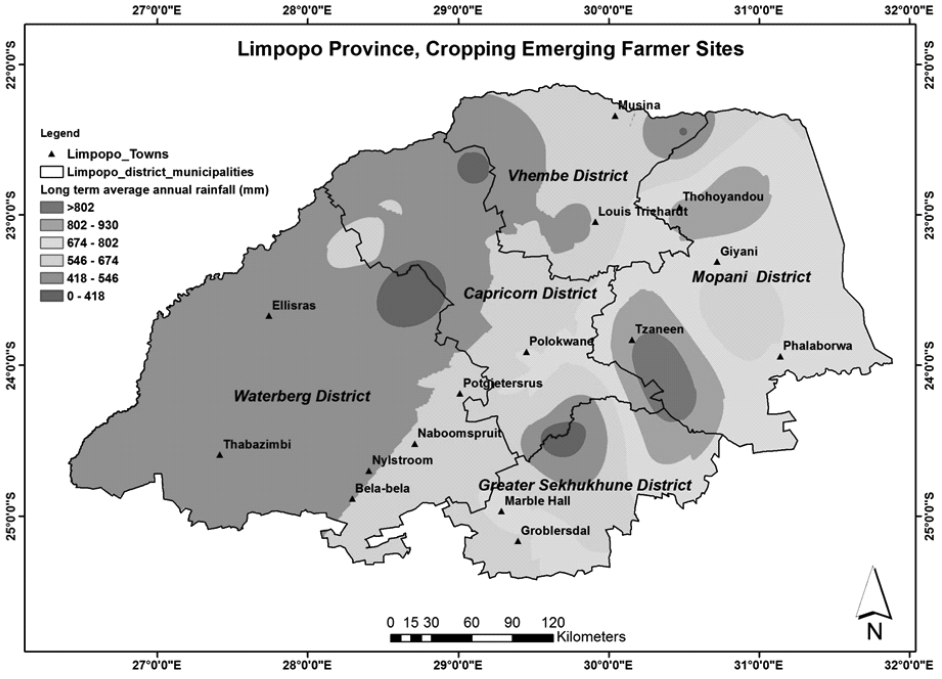

Fig. 1. Limpopo province, cropping emerging farmer sites

systems were obtained largely through observations and interviews using structured questionnaires. The content of the questionnaire was based on a format developed by the International Centre for Research in Agroforestry (ICRAF) but modified to suit local conditions (Nair 1989). Interviews conducted were participatory in nature involving researchers, agricultural extension personnel and farmers. Three broad approaches were utilized, to make contact with farmers, namely: i) use of district or local extension personnel, where, through prior arrangement, specific farmers falling under the supervision of the extension personnel were visited and interviewed; ii) use of farmers groups who are usually large (20 to 50 families), these are well organised groups of farmers owing several farms within a specific locality; iii) visits to farmers' fields without any prior arrangement and this approach was effective in reaching individual farmers who are neither under the supervision of extension personnel nor belong to any farmers group. The use of any particular method was largely influenced by the locality concerned.

RESULTS AND DISCUSSION

The greatest diversity of crop tree combinations occurs in the medium to high rainfall zones. The abundance of tree species within these two rainfall regimes offers greater potential for selection of Agroforestry woody perennial for efficient water use in Limpopo province (Ong et al. 2007; Khaine et al. 2017). In the drier environment, species abundance could be different as reported by Xu (2015). The dominant tree species across rainfall regimens in the province are presented in Table 1.

The Vhembe District

Very High Rainfall Zone (>1000 mm)

This high rainfall zone occurs only in the communities around Levubu and Tshakuma. The area around Levubu is predominantly occupied by commercial white farmers. The few resource-poor farmers found in this rainfall zone are located mainly in the tribal area of Tshakuma and hence the agroforestry practices in this zone are limited to this tribal community. The land area

Table 1: The proportion of woody perennial species present in agroforestry system and their functions in homesteads and farmlands under the medium to high rainfall zone (601 - 1000 mm)

Homestead Trees/Shrubs			*Farmland*		
	Proportion (%)	*Function/uses*	*Tree/ Shrub*	*Proportion (%)*	*Function/uses*
Mango (*Magnifera indica*)	11	fruit, fuelwood, shade	Acacia (*Acacia spp.*)	11	shade, fuelwood
Pawpaw (*Carica papaya*)	10	fruit	Jackal-berry (*Diospyros mespiliform*)	9	fruit, medicinal
Mulberry (*Morius spp*)	9	fruit, shade	Fig (*Ficus spp*)	9	fruit, shade
Peach (*Prunus persicu*)	9	fruit, shade	Mango (*Magnifera indica*	8	fruit, shade
Banana (*Musa sapientum*)	7	fruit	Syringa (*Kirkia acuminata*)	7	carving, shade, live fence
Guava (*Psidium guaajava*)	7	fruit	Peach (*Prunus persicu*)	7	fruit
Marula (*Sclerocarya birrea*)	6	fruit. alcohol, shade	Marula (*Sclerocarya birrea*)	5	fruit, alcohol, shade
Citrus (*Citrus sinensis*)	5	fruit	Avocado (*Persia amaericana*)	5	fruit, shade
Fig (*Ficus spp*)	5	fruit, shade	Citrus (*Citrus sinensis*)	3	fruit
Syringa (*Kirkia acuminata*)	4	carving, shade, live fence	Guava (*Psidium guajava)*	3	fruit
Acacia (*Acacia spp*)	3	fuelwood, shade	Mobula plum (*Parinari curatellifolia*)	3	fruit, seed as nut
Camel foot (*Piliostigma thonningi*)	2	feed, shade	Sickle bush (*Dichostachys cinerea*)	3	feed, fence, fuelwood, medicinal
Avocado (*Persia amaericana*)	2	fruit	River bushwillow (*Combretum erythrophyllum*)	3	timber, shade, carving
Cross-berry (*Griwia occidentalis*)	2	fruit, feed, medicinal	Paperbark false thorn (*Albezia tanganyicensis)*	2	medicinal
Puzzle bush (*Ehretia rigida)*	2	feed, fruit, ornamental	Banana (*Musa sapientum*)	2	fruit
Jackalberry (*Diospyros mespiliform*)	1	fruit, medicinal	Apple-leaf (*Lonchocarpus caparsa)*	2	feed, carving, medicinal
Sickle bush (*Dichrostachys cinerea*)	1	feed, fence, fuelwood, medicinal	Cross-berry (*Griwia occidentalis*)	2	fruit, feed, medicinal
Wild apricot (*Dovyalis zeyheri*)	1	fruit, jelly, fence, carving	Wild apricot *(Dovyalis zeyheri*)	2	fruit,jelly, fence, carving
Weeping Boer-bean (*Schotia spp*)	1	ornamental, medicinal	Apricot	2	fruit
Apple (*Malus domestica)*	1	fruit	Wild medlar (*Vangueria infausta)*	2	fruit
Grapes (*Vitis vinifera)*	1	fruit	Others	10	-
Pride of De kaap (*Bauhinia galpinii*)	1	hedge, ornamental	-	-	-
Others	9		-	-	-

N=57

available for production generally ranges from approximately 0.5 – 1.0 ha. Trees grown are avocado, guava, banana, pawpaw, mango, litchi, and macadamia nut. Occasionally, maize or leafy vegetables could be found growing together with mango, banana, and / or pawpaw. However, when one pools several neighbouring farms, the system could be considered as agroforestry which is dominated by fruit trees. About 60 percent of the farmers have access to flood irrigation which is used to supplement the natural rains.

Livestock production is not a major component of the system in this region as less than 25 percent of the farmers keep stock animals such as cattle and goats for subsistence and sometimes as drought animals. The animals are allowed to roam the fields after the annual cereal and grain crops are harvested to feed on stovers and other plant residues. Droppings from the animals help to fertilize the soil, though this does not appear to be significant.

High to Medium Rainfall Zone (601-700; 801-1000 mm)

Diverse tree species of different proportions are maintained in both the homestead and farmland agroforestry systems under this rainfall zone. The land area at the homestead is usually not more than 600 m^2 whereas the farmlands ranged from 0.75 to 1.5 ha. Combinations of indigenous and exotic fruit tree species occur in the various systems in the area. Exotic fruit trees dominate the homestead systems (60%) whereas on farmlands, indigenous trees account for approximately 68 percent of the tree species retained on farms. The dominant species in the homesteads are mango, pawpaw, mulberry, peach, banana and guava. On farmlands, acacia, jackal-berry, wild fig, and syringa are the dominant indigenous species. It was also observed that more tree species occur around homesteads than there are on the farmlands. This is due to better care of trees such as fencing of seedlings and frequent watering around homestead by a household compared to those on the farmlands. The apple leaf tree (*Lonchocarpus caparsa)*, though not occurring in large proportion in this area possesses the characteristics of dropping its leaf at the onset of the spring season. It could therefore be effectively incorporated into the farming system of the area as an agroforestry species without interfering with the summer arable crops. Across the homestead and farmland agroforestry systems, trees provide diverse functions and uses which include food source, shade, fuel wood, windbreak, soil improvement and demarcation/ fencing.

Diverse field crops are cultivated by small-scale farmers in this region, over 90 percent of which occur in different intercrop combinations. Maize pumpkin and maize-cowpea are important intercrop combinations in the homesteads whereas maize-cowpea and maize-groundnut are the dominant intercrop combinations on the farmland systems. The use of leguminous plants is known to improve the soil and crop yield (Chiwa 2000; Sileshi et al. 2008).

The trees were not necessarily planted by the farmers but were present on the fields during time of land preparation and cultivation. More woody perennial species are being used for fuelwood (52%) and structures such as housing (28%) and fencing (20%). About 50 percent of the farmers surveyed do prune the trees in the agroforestry systems especially when severe shading occurs.

Cattle, donkey and sheep are the main stock animal kept in this area. The number of cattle per family varies from 0 to 5 but few individuals in the community own cattle in excess of 40. The animals feed mainly on acacia, fig, mulberry and other perennial species within their reach. However, in winter months when cropping activities are limited, maize residue left from the previous season constitute the main feed for the animals. There appear to be no control over the movements of the animals and therefore winter cropping could be effectively carried out only when fences are erected around the farms. Due to this reason, several farms were not cultivated as farmers do not have enough funds to fence their farms.

Low and Very Low Rainfall Zones (501 - 600; < 500 mm)

The low and very low rainfall zones occur in areas around Punda Maria, Musina, Mopane, and Bridgewater. Grain sorghum is grown by farmers in the region with Mopane tree (*Colophospermum Mopani)* dominating the system. Occasionally grain sorghum- Mopane system could be found on the farmers' fields. A narrow strip to the west of Musina from the Limpopo River is an area used for the production of cotton, tomato and other fresh vegetables for the

fresh produce market. Emerging commercial black farmers are mostly found along the Nwanedz River where they are engaged in tomato and paprika production. Tree crops combination is minimal in this area. The few trees present on croplands are mostly left at the outskirts of fields for shade as well as demarcation. The trees currently found on the farmlands were not necessarily planted by farmers but they happened to be there naturally. Roughly 52 percent of the farmers were contemplating getting rid of the trees since they anticipated that it was interfere with their crop production and they had no intention of having any more trees in future. Twenty two percent indicated that they would prefer having trees only in the homesteads and 26 percent prefer fodder trees

The Capricorn District

Low Rainfall (501 -600 mm)

Most of the farming activities in this area occur on farmlands though a number of home gardens were observed. About 82 percent of the farmland surveyed were at least 1 ha but several farmers appear to have more than one farm. Over 90 percent of the trees occurring on farmlands in this rainfall zone are indigenous. Marula is the dominant species, constituting 12 percent of the species. Other species include the jacklesberry, silverleaf, pawpaw, jackaranda, chineseberry, and wild fig, each accounting for 8 percent of the tree species. Important crops grown on farmlands are maize (22%), followed by cowpea, groundnut and pumpkin, each accounting for 15 percent of the crops grown. Similar to other districts, marula-maize agrisilvicultural system is the most widespread practice, constituting 27 percent of the tree crop combination. Silverleaf-maize combination is also an important combination accounting for 18 percent of the agrisilvicultural practices in the area. About 43 percent of the trees occur in an intimate mixture with crops on the farms whereas the rest are located on or closer to the boundaries. The main reason for keeping trees in the area is to provide food, shade and firewood. The average number of trees per hectare of land was estimated to be 15. There is also no regular pruning of trees in the farming system.

Cattle is the main stock animal kept in this area. The source of animal feed is mainly the veld as well as crop residue on croplands during the winter months. Young seedlings of marula and other forage species are also grazed upon during this period of communal grazing. Grazing young seedling of tree species constitutes a major setback for regeneration of woody perennial species in the area.

Very Low Rainfall (<500 mm)

A more diverse indigenous and exotic tree species are maintained in the homestead in the Dikgale-Solomondale area but wild fig, buffalo thorn and peach trees tend to dominate the systems in this area. Indigenous trees are more prevalent on farmlands with acacia spp. accounting for about 31 percent of the trees present. The Acacia species is a legume and if it is effectively utilised as an agroforestry species through pruning and mulching, it can contribute to the building of the soil fertility of the farm lands (Sileshi 2012). Due to the wide variety of tree species, a wider combination of agrisilvicultural practices occur in this region. Buffalo thorn in combination with maize and cowpea or sweet sorghum and cowpea are the major combinations accounting for about 17 percent of the homestead agrisilvicultural systems. Acacia with maize-cowpea, or sorghum-cowpea are important on the farmlands and constitute 12 percent of the system. Marula, sicklebush, camel's foot and again buffalo thorn are also important trees on the farmlands. Under the homestead system, position of trees were in rows, random mixture or along the boundaries, whereas on the farmlands, about 71 percent of the trees occurred on boundaries of the farms and the remaining 29 percent located randomly on the farm. There is limited agrisilvicultural systems in the Bochum area and the surrounding communities due to scarcity of water. Over 70 percent of the homegardens surveyed had more than 10 trees within an area of about 300 m^2.

The farming community in Dikgale-Solomondale area hardly involves livestock component, though the farmers are eager to engage in this enterprise. The main reason for the limited livestock production according to the farmers, is the general lack of adequate fodder in the entire community to sustain the animals. Most part of the district is characterised by the native vegetation with *Acacia species* dominating the land-

scape. Winter months are severely dry with very little green fodder species and hence high rates of stock mortality during these periods are common. Identification of suitable agroforestry trees capable of maintaining foliage for livestock throughout the year will in no doubt contribute to food security in this region. Farmers mentioned the need for assistance in enhancing the use of fodder trees and shrubs if agroforestry practices is to be promoted in this dry environment.

The Mopani District

Very high rainfall zone (>1000 mm)

Both indigenous and exotic tree species are present in this rainfall zone, with Jacklesberry dominating the system (21%). This is followed by marula, pawpaw, banana and mango, each accounting for 14 percent of the trees on farmlands (Table 1). Other species such as avocado, natal mahogany and pigeonpea are present in the agroforestry system. Leafy vegetables are the main crops grown (44%) followed by maize and tomatoes, each constituting 22 percent of the crops grown. About 71 percent of the maize produced are in sole stands. Maize-pumpkin is the only major intercropping practice observed in the area. Mango and pawpaw in combination with maize and vegetables are the major tree-crop combination in the area accounting for 50 percent of the agrisilvicultural practices. Other important practices are marula-maize-vegetables, marula-maize, banana-maize-vegetables and pigeonpea-maize-vegetables. The trees generally occur in random mixture on the land or are located on the boundaries. About 77 percent of the farmers interviewed indicated that, provision of food source is the main reason why the trees are maintained on the farmland. The estimated number of trees per hectare in the area was nine. The definite preference for fruit trees in the area is primarily due to the favourable rainfall and other climatic factors which naturally sustain this farming activity. About 60 percent of the farmers surveyed prune the trees in the agroforestry system especially when severe shading occurs. There is a reduction in tree and shrub density and is primarily due to demand of space for cropping (76%), structures such as housing and fencing (15%) and for fuelwood.

Cattle is the main stock animal kept in this area and similar to other areas in the province, the sources of feed are from grasses on the natural veld, woody perennial species such as acacia, fig, mulberry and other perennial species within their reach and then on crop residue during winter months.

Medium to High Rainfall Zone (601 - 1000 mm)

A wide array of indigenous and exotic tree species are maintained on farmlands in the area. Marula and banana are the dominant trees (about 13%), followed by guava, pawpaw and mango, each constituting about 9 percent of the trees on farmland. Other important trees are Jacklesberry, avocado, and silverleaf. Several crops are produced by farmers in this area but the dominant ones are maize (22%), leafy vegetables (19%), cowpea and pumpkin (11% each). Though sole maize is a major cropping practice (42%), several intercropping of the various crops are practised by the farmers. Due to the diversity of tree and crop species occurring in the area, several tree-crop combinations could be found on the farmers' field. Marula-maize and Jacaranda-cocoyam are dominant, accounting for about 13 percent of the agrisilvicultural practices in the area. About 48 percent of the trees are located in an intimate mixture with crops whereas 28 percent occur along the boundaries of farmers' field. Similar to the very high rainfall regions interviewed, about 77 percent of the farmers keep the trees as food source and 20 percent for shade. Tree and shrub seedlings are usually grazed upon before they could be fully developed into mature trees. Other reasons include use of wood for fencing (10%) and structures around the homesteads (4%).

Cattle is the main stock animal kept in this area. Other livestock in the area include sheep and goats whose numbers vary from 8 to about 20 per household. The majority of the livestock graze on grass from the veld and also from residue on croplands during winter months when crops are harvested.

Low Rainfall Zone (< 500 mm)

The main areas surveyed in this zone were Phalaborwa, Namakgale, Lulekani and Makhushane. Indigenous tree species dominate the farmlands in this area with marula comprising about 19 percent of the species. The other main exotic

fruit trees in the area are mango, avocado, pawpaw, peach and banana. There is less diversity of crops grown in the area compared to the medium and high rainfall areas. The major crops found in the areas were maize, leafy vegetables and groundnuts and these account for roughly 64 percent of the crops in the area. Marula-maize is the main agrisilvicultural practice (18%) with marula-groundnut and false-marula-tomato comprising about 7 percent each of the tree-crop systems. About 73 percent of the trees occur along the boundaries of the farm and 23 percent on the farmlands. The main functions of the trees are to provide shade or food though use of trees for fuelwood is also important in the area.

The main stock animals are cattle, sheep and goats. The number of cattle per household varies from 6 to 13. Similar to other communal systems, the animals graze on grass species from the veld as well as woody and shrub species within their reach during summer months and on additional feed from crop residues from farmlands during winter months.

The Sekhukhune District

Medium Rainfall Zone (601-800 mm)

A great diversity of indigenous and exotic fruit trees species could be found in this region and no particular species appear to be dominant. However, important trees in the farming system include guava, peach, lemon and malicazearac each accounting for about 9 percent of all the types of trees found on croplands. Other important trees are jacaranda, mulberry, and loquet. Leafy vegetables and maize constitute 36 percent and 21 percent respectively of the crops grown on the farmers' fields whereas watermelon and tomato accounts for 10 percent of the crop. Other crops grown in the area are wheat, soybean, cotton, and pumpkin. There is no dominant agrisilvicultural system in the area but some of the common practices are marula-vegetables, marula-tomato, Jacklesberry-sweet potato, bush willow-bambara groundnuts and jacaranda-bambara groundnut. About 44 percent of the trees are located on the boundaries and 33 percent in intimate mixture with crops on the farms. Sixty percent of the farmers admitted having had more trees in the region than it is currently present and out of these 75 percent attributed the reduced population to clearance for annual cropping, 18 percent attributed it to demand for fuelwood and 7 percent to utilization of the species for structures, fences and buildings. Regarding farmers intention to grow trees, about 32 percent of the farmers expressed the desire to grow indigenous trees and shrub species provided the trees are planted on boundaries of the croplands

Cattle is the main stock animal kept in this area. The animal feed is mainly from the veld as well as from crop residue on croplands during the winter months. Tree and shrub species such as marula, mulberry, and acacia that is within reach of the animals is grazed upon.

Low Rainfall Zone (501-600 mm)

The towns falling under this rainfall category include Lebowakgomo, Veerplatz, Strydkraal, Sipitsi, Andreisdraal, Jane Fuss, parts of the Nebo district and Sekhukhune and surrounding communities. The major tree and shrub species identified on farmers' fields in this area are acacia, marula, pawpaw banana, bluegum and maliacazedarac, each comprising about 14 percent of the trees. Less crop diversity was found in the area but production of leafy vegetables and tomato appear to be major enterprises. Other crops found in the area are cotton, sorghum and wheat. The majority of the crop appeared to be produced in pure stands probably due to the low available moisture which might not be favourable for intercropping. Apart from the marula-grain sorghum system which accounts for about 42 percent of the tree-crop systems, there are no distinct agrisilvicultural practices in most parts of the region. Pawpaw and banana with leafy vegetables or tomato were however observed in the area each constituting 11 percent of the system. The other tree-crop combinations are so scanty, they could hardly be described as systems. Restrictions on felling of Marula trees by tribal laws has contributed to increased proportion of the tree species in the systems wherever it occurs.

Arrangement of trees on the fields did not seem to follow any particular pattern since single rows, mixed arrangement with crops, location on boundaries of the farms were observed in equal proportion (33%). Roughly 57 percent of the farmers interviewed indicated food source as the main reason why trees are retained on

their farms with 28 and 14 percent indicating windbreak and shelter respectively as the reason. More than 50 percent of the farmers do not keep trees on their farmlands and the reason given was again the need for space for their annual crops. About 50 percent indicated that they prefer to keep shrubs for fodder (30%) and fruit trees (28%).

Large stock (mainly cattle and donkey) as well as goats and sheep form a major component of the farming system around the Lebowakgomo and Sekhukhune region and similar to other regions, movement of the animals on croplands are restricted during summer-growing months but are released during winter months after crop harvest.

The Waterberg District

The Waterberg district has the medium, low and very low rainfall classification and major towns within the classes are as follows: medium rainfall (Naboomspruit, Potgiestersrus, Mahwelereng, Sterkwater), low rainfall (Roedtan, Thusang, Tuniplass etc.) and very low rainfall (Bakenberg, Swartwater, Marken). The Waterberg district is predominantly white owned commercial farming activities and hence little traditional agroforestry practices occurs in the area. Small holder agroforestry system as practised by black farmers is negligible in the area. The low rainfall received in this district should not limit agroforestry interventions in this area. With proper planning and identifications of adaptable tree and shrub species, the current landscape can be improved through agroforestry for the benefit of the farmers and the rural and rural communities (FAO 2017).

Additional major towns within the rainfall classes are as follows: medium rainfall (Warmbad, Settlers, Thabazimbi, Vaalwater, Leeuport etc.) low rainfall (Nylstoom, Alma, Koedoeskop, Northam, Pienaarsrivier etc.) and very low rainfall (Orangefontein, Villa Nora, Ellisras etc).

The Waterberg district is characterised by predominantly white owned commercial agricultural activities and game farming. There are however isolated small-scale farming activities around Elisras in the very low rainfall zone. Majority of farmers (67%) who are interested in having tree base agroforestry systems prefer trees for either firewood or building.

The rainfall in the area do not permit active crop production and there are hardly any trees left on the croplands. Acacia bush is quite dominant in the region and in some places it is creating bush encroachment problems

CONCLUSION

The survey on agroforestry practices among smallholder farmers in the Limpopo province revealed the following:

Farmers in the Limpopo Province are already practicing agroforestry and the intensity of the practice is largely dependent on the annual rainfall received in a particular locality. The density of trees and shrubs retained on or around farmlands tend to increase with increasing amounts of rainfall. In the high to very high rainfall areas, farmers prefer to retain fruit trees rather than indigenous species on the croplands. Exotic fruit also tend to dominate the homegardens whereas indigenous fruit trees prevail on the farmlands.

Maize is the dominant annual crop grown by the farmers but other important crops include cowpea, groundnut, sweet potato, bambara groundnut, pumpkin, watermelon and sorghum. Almost all the crops are grown as intercrops.

Livestock production is on communal basis with the natural rangeland as the main source of feed, although crop residue from croplands during winter months significantly contribute to feed for the animals. Tree and shrub species on the rangeland that is within the reach of the animals is also an important feed source.

Across the various rainfall zones, it was generally observed that the trees and shrubs are retained on croplands for reasons such as provision of food, shade, fuelwood, windbreak and poles for structures and for demarcation.

Farmers indicated that they had more tree and shrub species on and around the crop fields in the past than it is currently present. Demand for fuelwood, poles for structures, interference with land preparation and shading of annual crops are among the reasons given for the species disappearance.

Most of the farmers interviewed have strong interest in practicing intensive agroforestry systems but they do not see the practicality of it due to a number of constraints facing them in their agricultural practices. Important constraints

mentioned include limited land area per household which cannot accommodate trees, lack of land ownership for long term investment in the woody perennial species. The land tenure system has placed constraints on long-term investment in land limiting the desire to expand agroforestry practices

Another major constraint is inadequate water in the drier areas for successful tree production. Although over 65 percent of the farmers have the permission work on the land, the tribal chief still plays a significant role in land allocation and acquisition. Security of land tenure is an important factor in agricultural development in many developing countries and lack of clearly defined land tenure weakens incentives for long-term investments in land to raise its productivity.

Majority of the farmers operate on approximately 1.0 ha of land and there was a general feeling among them that, trees occupy large space which could limit production of main crops.

Despite these challenges, a significant proportion of the farmers expressed strong desire to try agroforestry as part of their farming system.

RECOMMENDATIONS

There is a need for further studies to assess the effectiveness and impact of agroforestry practices and its benefits in the smallholder farming sector of Limpopo province.

Furthermore, documenting cultural beliefs and taboos regarding tree planting and how they influence adoption of agroforestry by small-scale farmers across South Africa would be necessary.

Decision-making regarding research, pilot studies and scaling out intervention should be carried out with careful planning and farmers' involvement to enhance the adoption and maintenance of agroforestry in the province. Specific agroforestry systems could be established in the different agroecological zones of the Limpopo Province.

In order to integrate trees into the farming systems, farmers have to be aware of the short and long term benefits of this practice.

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