AGROFORESTRY STRATEGY FRAMEWORK

FOR SOUTH AFRICA

MARCH 2017

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LIST OF ABBREVIATIONS

AEZ	Agro-ecological zone
AF	Agroforestry
AfDB	African Development Bank
ARC	Agricultural Research Council
CARA	Conservation of Agricultural Resources Act
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DAFF	Department of Agriculture Forestry and Fisheries
DEA	Department of Environmental Affairs
DED	Department of Economic Development
DoH	Department of Health
DRDLR	Department of Rural Development and Land Reform
DST	Department of Science and Technology
DWS	Department of Water and Sanitation
FAO	Food and Agriculture Organisation of the United Nations
GHG	Greenhouse Gas
ha	Hectares
ICRAF	International Centre for Research in Agroforestry (Now known as World Agroforestry Centre)
IPCC	Intergovernmental Panel on Climate Change
NAPAS	National Adaption Plans of Action
NMAS	National Appropriate Mitigation Action
NDP	National Development Plan
NEMBA	National Environmental Management: Biodiversity Act
NGO	Non-Government Organisation
P	Phosphorous
REDD	Reducing Emissions from Deforestation and Forest Degradation
SADC	Southern African Development Community
SEF	Sahelian Eco-Farm: alley cropping
SFRA	Stream Flow Reduction Activity
SOC	Soil Organic Carbon
UNCCD	United Nations Convention to Combat Desertification
UNFCC	United Nations Forum to Combat Climate Change

PREFACE

South Africa is faced with multiple challenges of land degradation, low levels of productivity in rural communal areas and persistent rural poverty. As a water scarce country, these challenges have been brought into sharp focus by the recent (2016 and possibly on-going) devastating drought, which affects farmers, pastoralists and foresters. This is further exacerbated in the face of climate change where the incidence of such extreme events is predicted to increase and further erode rural livelihoods. As a signatory to the Paris climate agreement, South Africans are obliged to take action on climate change. Pledges to mitigation and adaptation efforts focus largely on agriculture and land use changes to reduce carbon emissions and increase sequestration. In addition, introduction and practicing climate resilient land use systems are critical for ensuring that land users adapt to climate change. The Sustainable Development Goals (SDGs) of the United Nations highlight the importance of reconciling social, economic and environmental objectives. Transition to more sustainable land use practices is critical to achieve ecological integrity and sustain and advance rural livelihoods. Agroforestry is a land use system that combines the use of woody perennials with agricultural crops and / or animals that aims for beneficial ecological and economic interactions for food, fibre and livestock production. Agroforestry systems aim to provide multiple benefits and can contribute to many social, economic and ecological objectives, including food security, income generation, additional fuel and fibre resources, carbon sequestration, erosion control, landscape rehabilitation and enhance climate resilience in so doing. It is within this context that the Department of Agriculture, Forestry and Fisheries (DAFF) identified agroforestry as a system that can benefit farmers, foresters and pastoralists in a range of contexts. This agroforestry strategy framework sets out a starting point to develop this beneficial land use system for the benefit of the people of this country. The strategy will be implemented in support of other programmes of the department such as Conservation Agriculture, Climate Smart Agriculture and Land Care.

This document was prepared through a collaborative effort between The Department of Agriculture, Fisheries and Forestry and the Institute of Natural Resources

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1   BACKGROUND

The background chapter provides an overview of the strategy development process summarises literature review conducted to research agroforestry (AF) and provides current definitions for AF. Furthermore, the background provides a problem statement and considers the policy frameworks that informed the development of the agroforestry strategy framework.

1.1   The process of strategy development

This agroforestry strategy framework has been developed over a period of 12 months, through a collaborative effort between the Department of Agriculture, Forestry and Fisheries (DAFF) and Institute of Natural Resources (INR). The strategy framework was informed by input from various stakeholders, including national, provincial and local government, academics, foresters, farmers and development practitioners.

The activities to inform the framework started with information sharing session with DAFF representatives to gather available information and understand key issues that should be considered in the development of the strategy. This was compiled into a Key Issues Paper (see Appendix 2). A review of literature on agroforestry as well as a policy review was conducted. The purpose of this was to identify how and where agroforestry practices can contribute to current policy objectives, in particular, those related to food security, income generation, diversifying livelihoods, addressing environmental degradation and climate change (specifically the Land Care, Land Use Management, Crop production and National Extension). Subsequent to the literature review, interviews with key informants in the private sector, the public sector and researchers were conducted to understand the current status of agroforestry in South Africa, and to learn what is required to amplify agroforestry practices in South Africa.

Based on the literature review, interviews with key informants, and with inputs from DAFF stakeholders, and the draft and revised key issues paper was compiled, which provided the basis for the first draft of the strategy. The first draft was presented to DAFF Stakeholders at a national workshop in May 2016 and was amended based on this input. The second draft of the strategy was then presented to provincial stakeholders in a series of multi-Stakeholder workshops with government representatives, researchers, the private sector and NGOs, which was completed in July 2016. The input from the multi-stakeholder workshops resulted

in further refinement of the strategy and the development of an implementation plan to give effect to the strategy. Thus, this current version is the fourth draft of the strategy.

This strategy framework provides a summary of the literature review and policy review, followed by a summary of the key issues paper, highlighting key challenges for agroforestry development. The strategy framework provides a vision for agroforestry proposes a working definition of agroforestry for South Africa and defines key principles that should inform thinking when implementing the strategy.

This is followed by the strategy itself, which is made up of three Themes:

Theme 1: Creating the Enabling Environment

Theme 2: Knowledge Development

Theme 3: Putting Agroforestry into Practice.

For each strategic theme there are a number of goals and for each goal, a set of objectives that are necessary for each goal to be achieved. Associated with the strategy is the implementation plan which provides detail on key actions and outputs from the strategy. Included in the implementation plan are indicators against which progress with implementing the strategy can be monitored.

1.2   Literature review

This section highlights key points from the detailed literature review.

1.2.1   *Defining agroforestry*

Prior to the development of modern agriculture and forestry systems, farmers were engaged in more sustainable land use practices that included a variety of crops. In Central America, farmers would produce trees (e.g. papayas, coconut, cocoa and citrus), shrubs (e.g. coffee and) in combination with annual crops (e.g. maize, squashes and beans) (King, 1987; Nair, 1993)). Similarly in Asia, farmers would leave trees in their fields to prevent excessive evaporation after the rice season. In Africa, a mixture of maize, pumpkin and beans were planted under the cover of scattered trees (Forde, 1937).

Technological advances for example mechanization, improvement of crop varieties and development of agrochemicals (fertilizer and pesticides) facilitated a shift away from these land use practices and towards large-scale monoculture (Briney 2015), resulting in the so-called 'green revolution' which has contributed to the decline in multicropping systems and declining agricultural sustainability (Nair 1993).

In the 1980s, despite promoting monocultures in certain areas, it was found that farmers continued to plant their crops in mixed stands, which included trees, resulting in a resurgence of research by agricultural, environmental, forestry and social scientists in this farming system (Papendick *et al.* 1976). This combined with a growing recognition of large-scale deforestation and associated land degradation resulted in the development of formal research into the subject of agroforestry (World Bank, 1991). Since the 1980s, there has been resurgence in agroforestry research, motivated by current concerns of environmental sustainability and resilient farming systems in the face of climate change (Nair, 1993 Leakey et al. 2012; FAO 2013).

The first official agroforestry definition was introduced by the International Centre for Research in Agroforestry (ICRAF) in 1982, where agroforestry was defined as follows:

"A deliberate growing of woody perennials on the same unit of land as agricultural crops and/or animals, either in some form of a spatial arrangement or sequence; which must consist of a significant interaction (positive or negative) between the woody and non-woody components of the system either ecological and/or economical (Lundgren 1982)".
It was later refined into this widely used definition:

"Agroforestry is a collective name for land-use systems and technologies where woody perennials are deliberately used on the same land management unit as agricultural crops and/or animals, in some form of a spatial arrangement or temporal sequence. In agroforestry there are both ecological and economic interactions between different components (Lundgren and Raintree 1982)".

The Food and Agriculture Organisation of the United Nations (FAO) on the other hand defines agroforestry as

"A system that includes both traditional and modern land use systems in which trees are managed together with crops and/or animal production systems in agricultural settings".

Agroforestry includes a full range of tree planting and woodlot management practices e.g. living fences, hedges, woodlots, fruit trees near houses and woodland use. The definitions show that agroforestry can be defined by a region or country based on the dominant systems and practices dictated by the biophysical and socio-economic attributes of a particular area. Therefore the strategy for South Africa should define agroforestry in a local context taking into consideration the suitable and preferred systems and the local socio-economic context and should include a holistic approach to land use.

1.2.2   *Classification of agroforestry systems*

The most common classifications are as follows:

- Agrisilvicultural – a combination of crops and tree species
- Silvopastoral – a combination of trees, pastures and animals
- Agrosilvopastoral – a combination of crops, trees, pastures and animals

Within each main classification, there is a detailed range of different practices, which are provided in Appendix 1.

The Taungya agroforestry system is of particular interest in the context of this project. This system was developed by the British in Burma during the nineteenth century (Menzies 1988) and was introduced in South Africa around 1880 (Hailey, 1957). Taungya is an agroforestry system in which farmers/labour is allowed to plant crops in between timber trees during the early stages of forest plantation establishment. Cultivation of agricultural crops usually goes on for 3-4 years until canopy closes. It was a modification of shifting cultivation which was destructive to the forest reserves in British India. Dietrich Brandis introduced the system as the way of dealing with villagers who were encroaching on forest reserves (Menzies 1988). The farmers are allocated land by the state, to plant and manage trees crops in the same area in exchange of the opportunity of growing their annual crops on government forest reserves (Nair 1993). This is quite relevant to smallholder plantation farmers of South Africa, since returns in traditional timber production systems are only seen after 8-10 years. Therefore for the first three years before canopy closure, farmers can have access to plantations to produce food and graze livestock that will support their livelihoods.

1.2.3   Agroforestry benefits

Agroforestry contributes to food security by providing multiple products and benefits to farmers. These benefits include food, fodder and shade for livestock, timber and renewable wood energy. It improves agricultural production by improving soil conservation, soil water holding capacity, soil organic matter, soil fertility, and other ecosystem services. This land use practice has high potential to mitigate climate change through carbon sequestration. And also improves farmer's resilience to climate change impacts through provision of diverse income sources. This section discusses these benefits in detail.

Environmental benefits

Water use, soil water and water quality

Water scarcity is increasingly becoming a critical issue. Current drought conditions (2016) in Southern Africa highlight the importance of exploring water use efficient land use practices. Monoculture agricultural systems do not fully utilise rainfall due to losses from evaporation, runoff and deep drainage (Siriri *et al.* 2013). The presence of trees in an agroforestry system allows for increased quantities of water used for tree/crop transpiration while simultaneously improving the productivity of transpired water by increasing biomass production per unit of water used (Ong *et al.* 2007). The microclimate modification occurring under tree shade was reported to have a positive effect on water status, gas exchange and water use efficiency of the understorey grasses in Nairobi (Kinyamario *et al.* 1996). Agroforestry improves water use of a production system by allowing for utilisation of offseason rainfall, where the perennial plants make use of the additional soil water at greater depths. Accumulation of organic matter as a result of pruning residues and plant litter, improves the infiltration capacity of the soil and thus better water storage; (Siriri *et al.* 2013). Siriri *et al.* (2013) reported that *Sesbania Sesban* and *Alnus accuminata* planted on terraces improved soil water content by 9-18%. Riparian buffers grown along water bodies can improve water quality by reducing nonpoint source pollution (U.S. Department of Agriculture National Agroforestry Centre 2012). This is achieved through interception and filtering of pollutants (fertilizers, herbicides, pesticides, oils, salts) coming from watersheds and preventing sediments from croplands and eroding stream banks (USDA (NAC) 2011).

Erosion / soil improvement

Soil infiltration is a fundamental ecological process that positively affects water budget of vegetation, and reduces runoff and soil erosion (Wang *et al.* 2015). Adoption of AF as a land use practice can improve the physical and chemical properties of the soil, enhance soil infiltration capacity and influence soil water distribution processes (Neris *et al.* 2012). Growing trees and woody perennials on contours and field bunds reduces soil erosion. Research confirms that agroforestry enhances soil fertility, improves soil structure and soil organic matter (Lehmann *et al.* 1998; Lott *et al.* 2009; Duguma & Hanger 2011).Tree species used for agroforestry have a better nutrient cycling ability compared to monoculture systems (Mbow *et al.*, 2013). The release of nutrients from tree and pruning residues can be synchronized with the requirements for nutrient uptake of associated crops. Planting trees and crops in one area can create imbalances in nutrient availability; however the addition of high quality prunings to the soil at the time of crop planting can lead to a good degree of balance between nutrient release and demand. In Malawi and Zambia, farmers observed great improvements in soil fertility where shrubs like *Tephrosia vogelii, Sesbania sesban, Gliricidia sepium or Cajanus cajan* were used as improved fallows[1] for 2 years and cut back to plant maize (Kaczan *et al.* 2013).

Biological diversity and ecology

Agroforestry has a positive impact on landscapes connectivity through the influences exerted on the ecological processes such as the presence and spread of fauna and flora, water & nutrient cycling, microclimate and disease and pest dynamics (Schroth *et al.* 2004 ed.). The nature of an agroforestry system allows it to harbour higher biodiversity compared to monoculture systems. Biodiversity groups can range from insectivorous birds and bats (Cassano *et al.* 2009), tree seed-dispersing, pollinators enhancing crop yield (Olschewski *et al.* 2006) and amphibians providing biocontrol services. Traditional coffee-based agroforestry systems in the Americas have proven to be critical for protection of migration corridors for birds. Achievement of a system comprising of these biodiversity groups can result from the integration of various agroforestry practices leading to the creation of a complex mosaic of patches in an ecosystem (Leakey & Simons 1998). Each of these patches is composed of

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[1] Improved fallows involve the planting of legume species as a fallow crop for 2-3 years to improve soil nitrogen and organic matter content.

many niches occupied by different organisms thus making the system ecologically stable and biological diverse.

Climate resilience: mitigation and adaptation

Climate change has an adverse effect on food production and agroforestry has been identified as one of the measures that can be utilised to mitigate climate change (Nair and Nair 2014). There are two broad elements to addressing climate change, namely mitigation which involves reducing net carbon emissions; and adaptation, which relates to the adoption of new practices that make farming systems more resilient to the impacts of climate change.

Mitigation

The key elements of climate change mitigation are reducing greenhouse gas (GHG) emissions and sequestering carbon. In terms of the Kyoto protocol, countries agreed to reduce greenhouse gas emissions to at least five percent below 1990 levels within a specified timeframe. Non-Annex 1 parties (developing countries) which include South Africa do not have to make comparable cuts unless they choose to. However, in the future it is expected that these countries will also be obliged to reduce emissions. This is particularly relevant to South Africa as the largest emitter of GHGs in Africa (Glazewski, 2009).

Another key element of mitigation is carbon sequestration. Agricultural soils have great potential for carbon sequestration, particularly in land use systems that minimise soil disturbance and actively build fixed soil organic carbon (SOC). The modernisation of agriculture has resulted in the depletion of carbon as a result of deforestation, intensive cropping, soil erosion, soil disturbance thorough ploughing and other unsustainable agricultural practices. Where trees or shrubs are included on farms as part of an agroforestry system, the amount of carbon sequestered is increased, compared with monoculture agricultural systems, while also providing biomass-based fuel alternatives (Jose and Bardhan, 2012; Kirby and Potvin, 2007).

A number of studies have been conducted to evaluate the carbon sequestration potential of agroforestry. Estimates range from 0.29 – 15.21 Mg of C/ha/year above ground and 30-300 Mg C/ha below ground, up to one metre in depth (Nair *et al*, 2010); and agroforestry is recognised as a farming system that has the greatest potential for carbon sequestration. Agroforestry can increase carbon sequestration with improved management of agroforestry

systems, but more importantly, land use change to agroforestry can dramatically increase the accumulation of carbon stocks.

Jose and Bardhan (2012) conducted a review of the quantities of carbon sequestered in agroforestry systems and found the following:

- Intercropping with maize and a nitrogen fixing tree (*Gliricidia*) yielded a net gain of 3.5Mg soil C/ha/yr (cited from Makumba *et al*, 2007)
- Gaiser *et al* evaluated soil organic matter accumulation of *Leucaena leucocephala*, *Senna simaea* and maize through residue addition and found that the organic material incorporated increased the proportion of organic C in the light soil fraction significantly and the increase in organic C in the heavy fraction of the soil accounted for 39-51% of the increase in total organic C. The results indicate that, accumulation of C is feasible with the incorporation of large quantities of plant residues, but is dependent on the quality of the organic matter added.

The ability of an agroforestry system to sequester carbon compared to a single crop system has been reported in many parts of the world (Nair et al. 2010). An agroforestry system comprising intercropped trees and herbaceous crops allow for the storage of above-ground biomass accumulated over time, improved organic matter and hence more carbon stored in the soil (Kaczan *et al.* 2013). Rotation of staple crops with legumes or improved fallow reduces soil exposure and improves CO_2 storage in the soil.

Livelihood and food security benefits

Agroforestry plays a major role in the livelihoods of many rural households in sub-Saharan Africa. Most rural households in sub-Saharan Africa depend on subsistence farming, thus their lands have to be productive to ensure livelihoods and food security. Results from a study conducted to analyse the livelihood benefits in Kenya are represented in.

Fuelwood

Fuelwood is the main source of the total household energy requirements in southern Africa with the consumption varying from country to country e.g. 85% in Mozambique, 76% Zambia, 91% Tanzania, although substantially fewer people in South Africa are reliant on fuelwood as their main fuel source - 14% (Kalaba *et al.* 2010). In rural households fuelwood

is often collected from natural forests which results in forests degradation, while growing wood on farms reduces the harvesting pressure on natural forests (SOFO, 2005). In China, over 3 million ha of cropping lands is intercropped with timber trees particularly *Paulownia spp* with wheat (Sen 1991). It is estimated that about 75-85% of fuelwood in Indonesia, Sri Lanka, Java, Pakistan, Vietnam and the Philippines is harvested from agroforestry systems (Boeckmann & Lolster n.d.). Tobacco farmers in Tanzania started intercropping Acacia crassicarpa woodlots to produce fuelwood for tobacco curing; this reduces their tobacco processing costs (Ramadhani, Otsyina & Franzel 2002). Given the high dependence of many rural households in South Africa on fuelwood, the introduction of agroforestry systems that provide fuelwood can reduce energy costs and increase protection of natural resources.

Agricultural production benefits

Crop yield increases in agricultural fields planted in association with trees, be it legumes (Kwesiga and Coe 1994; Mafongoya et al. 2006) or multipurpose trees (ICRAF 2009). These increases occur because of improved microclimates, reduced wind speeds, improved soil organic matter and fertility.

Fodder

The farmer's ability to produce their own fodder can replace the expensive costs of purchased fodder (SOFO 2005). An initiative undertaken in east Africa resulted in more than 200 000 dairy farmers growing fodder shrubs as supplementary feed. These farmers observed an increase in milk production which allowed them to raise extra revenue from the milk sales (Place *et al.* 2009). The dairy farmers in Central Kenya plant shrubs such as *Calliandra calothyrsus* and *Leucaena trichandra* to feed their dairy herds (Franzel *et al.* 2003). In the Philippines, farmers grow a combination of improved fodder grass and trees (*Gliricidia sepium*) and this has helped them improve their livestock and crop production and reduced farm labour (Bosma *et al.* 2003). Local studies conducted by the Water Research Commission (WRC) indicated that leguminous trees (*Acacia karroo* and *Leucaena leucocephala*) can provide good quality fodder with crude protein content of 14.7% and 18.6% respectively compared to 3.5% crude protein of natural veld (Everson *et al.* 2011). High fodder production was also observed in alley cropping (682.91 kg/ha) compared to sole pasture cropping (124.60 kg/ha). Everson *et al.* (2011) identified silvopasture as an agroforestry system suitable for South Africa, with a careful selection and combination of trees, shrubs and crops.

Economic benefits (sales and income)

A variety of plants in an agroforestry system offers multiple harvests at different times of the year. Akinnifesi *et al* (2007) note that economic and livelihoods benefits from Indigenous Fruit Trees (IFT) in southern Africa can reduce household vulnerability and provide income generation opportunities, through semi-domestication. However, lack of improved germplasm, post-harvest losses and poor markets were identified as major constraints.

In a case study performed on the Sahel region, to determine the income differences between SEF (Sahelian Eco-Farm: alley cropping) and sole millet; it was found that the average income of farms was $600 per ha under the SEF system, which was 12 times more than the normal millet farm (Mission 2013). Negative effects of shading from parkland trees (*Vitellaria paradoxa; Parkia biglobosa*) caused a yield reduction of 50-80% of millet. However, farmers are prepared to take this yield penalty due to the great economic yields they obtain from the tree products (Verchot *et al.* n.d.). Ong et al. (1999) reported that accumulated income from tree products outweighed the accumulated value of crop losses by 42%. Coffee and cocoa are mostly grown under shade trees to reduce physiological stress on shade trees and provide income for farmers. The coffee/cocoa agroforestry are quite common in Indonesia and Central America; where shade trees may be timber, wood or fruit tree species while the understory crops are coffee or cocoa (Tscharntke *et al.* 2011). The coffee-growing small holder farmers of Peru derive about 28% of their income from shade tree and 72% from coffee (Rice 2008).

1.2.4   *Agroforestry in the South African context*

It can be seen from the literature review that there are few examples or reference to AF in a South African context. Guiney (2016) further notes that AF systems do occur in South Africa, albeit at a limited scale and extent.   Guiney (2016) notes further that the available information and research on AF practices in SA is highly fragmented, difficult to access or outdated. Through his research only seven AF projects that are currently operating were identified. While there may be other active agroforestry initiatives in the country which are not documented, this does provide an indication that AF is extremely limited. Furthermore, there are few recent research studies on AF in South Africa. Nevertheless, potential for expansion does exist. However, barriers to adoption and outscaling would need to be addressed, including institutional, technical, economic, policy and governance and social).

As a starting point, Guiney (2016) recommends the development of a national AF policy and strategy.

1.2.5   Summary

Agroforestry involves planting of multi purpose trees, legume trees and beneficial grasses which improves soil organic matter, replenish sol fertility, reduce erosion and excessive runoff thus mantaining healthy landscape and reduce chances of land degradation. Agroforestry systems are known to harbour and provide habitat to difference species ranging from pollinator insects, biocontrol and seed dispersal birds that sustain ecosystem service function.   These systems profide multiple benefits, addressing economic, ecological and social needs (Nair, 1993)

A Strength, Weaknesses, Opportunities and Threats (SWOT) analysis conducted by Guiney (2016) provides an accurate and relevant overview of what should be considered in taking AF forward in South Africa, which are addressed in the strategy – see Table 1..

Table 1.1: SWOT analysis of selected AF projects in South Africa (source: Guiney, 2016)

STRENGTHS	WEAKNESSES
- Increased agriculture / forestry production - Increased provision of environmental services - Diversification of income and risk reduction - Climate change adaptation and mitigation benefits - Monetary benefits – increased income from AF adoption - Decreased operational costs (e.g. herbicides and labour) - Potential prevention of forest fires	- Management of projects is remote – many people on the ground needed, and increased management costs - Lack of national coordination of AF interventions - Delayed benefits from AF activities (Long term investment of 5-7 years - Lack of focussed and documented research - Limited practical knowledge and applied research to address issues that affect AF - Lack of on the ground technical skills - Skills shortage – management and administration of on the ground operations - Lack of monitoring and evaluation of AF efforts - Lack of a national AF research / information sharing network - Competition with other crops
OPPORTUNITIES	THREATS
- Global carbon market (and other environmental service markets) - Potential government formal AF	- No formal government AF policy / programme to support AF - Climate change and climate variability

policy / programme to support the development and implementation of AF	• Unpredictability of carbon markets and lack of government legal and institutional framework for carbon markets
• Increased land value – preservation of land productivity and restoration of degraded land	• Lack of markets or incentives for ecosystem services or non-carbon benefits
• Potential linkages with conservation and climate smart agriculture	• Maintaining positive image for voluntary carbon markets
• Co-benefits (socio-economic) such as honey production, and tourism, increased wildlife viewing	• Potential risks of fire, pest and disease, theft, destruction
• Incentives to promote the development and implementation of AF activities	• Insecure land tenure and land reform
• Markets for diverse goods	
• Coordinated and collaborative research	

It has been noted by both authors that an effective and enabling policy environment is crucial for the implementation and upscaling of AF development. The effective promotion and regulation of AF through relevant policies or strategies can also aid in addressing the issues identified in Table 1.. An effective strategy is necessary to for support and buys in to achieve effective collaboration between government, development practitioners and researchers to support new AF initiatives.

Finally, Zomer *et al.* (2014), in a more recent publication of the World Agroforestry Centre, simply refer to Agroforestry as the inclusion of trees within farming systems. The authors go on to highlight that Agroforestry is not easy to define as it ranges from "subsistence, livestock, silvo-pastoral systems through home gardens, on-farm timber production, tree crops of all types integrated with other crops to biomass plantations, all operating within a wide diversity of biophysical conditions and socio- ecological characteristics" and that more recently the term includes the role of trees in landscape-level interactions, such as nutrient flows from forest to farm, or community reliance on fuel, timber or biomass available within an agricultural landscape.

1.3   Problem statement

Agroforestry is a system that can provide social, economic and environmental benefits to farmers, foresters and pastoralists in South Africa. The lack of an enabling environment to achieve the adoption and upscaling of AF requires an inclusive strategy that will guide the development of AF as a sustainable system of land use practices for the benefit of all.

1.4 Policy context

1.4.1 *International policy context*

The potential of agroforestry to contribute to sustainable development has been recognized in international policy meetings. The UNFCCC and the Intergovernmental Panel on Climate Change (IPCC) increasingly acknowledge it as a component of climate-smart agriculture. During the 2011 Conference of the Parties (COP) 17 meeting in Durban, agroforestry was frequently mentioned as having a strong potential for climate change adaptation and mitigation. Furthermore, National Adaptation Plans of Action (NAPAs) and Nationally Appropriate Mitigation Actions (NAMAs) take agroforestry as an important component in agricultural sector actions. In addition, the United Nations Convention to Combat Desertification (UNCCD) acknowledges agroforestry's potential to control desertification and rehabilitation. It is also seen as an important practice in the ecosystem approach promoted by the CBD and contributes to its Global Strategy.

For the promotion and widespread adoption of agroforestry, it is necessary to ensure that agroforestry can contribute to national policy priorities. Lack of support from the policy level is one of the main hindrances to wider adoption of agroforestry. This section examines various policy priorities and reviews important priorities of the National Development Plan (NDP).

1.4.2 *The National Development Plan 2030*

The vision of the NDP is to eliminate poverty and inequality by 2030. This vision will be achieved through drawing on the energies of South African people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout the society; with a focus on broad partnerships advance growth (NDP, 2011). The NDP realises that climate change has the potential to reduce food production and affect livelihoods with a disproportionate impact on women and children. This calls for industries and households to reduce their impacts on natural environments, enhance resilience of people and economy to climate change.

The NDP promotes a development of a strategy that **ensures household food security** through strengthening links between agriculture and nutrition. The NDP proposes policy

measures that promote an improved intake of fruits and vegetables and reduce intake of saturated fats, sugar and salt, as recommended in the South African Food Security policy. Agroforestry has been reported to have a significant impact on rural livelihoods of many households in African countries. The diversity of commodities involved in an agroforestry system contributes to food security and income generation.

1.4.3   *Additional policies relevant to agroforestry*

The following policies, strategies and legislation have a bearing on the strategy on Agroforestry in South Africa. Key aspects of the policies that are relevant to agroforestry are mentioned.

- **New Growth Path**: Setting the sector on a trajectory of higher economic growth and employment creation
- **The Medium Term Strategy framework (MTEF)**: Emphasis on employment creation, vibrant economy, rural development and environmental conservation.
- **Agricultural Policy Action Plan (APAP)**: Agroforestry fits well into the Fetsa Tlala programme of the APAP as it attributes integrated food production characteristics. The APAP promotes Climate Smart Agriculture (CSA) and hence agroforestry because agroforestry is one of the CSA land use practices which ensures sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change and reducing emission of greenhouse gases in relation to conversational practices (FAO, 2013).
- **DAFF Strategic Plan 2015/16 – 2019/20,** which lists the implementation of the agroforestry policy as a mechanism to ensure food security for small growers, while still waiting for their harvest, under the responsibility of the Director: Small scale Forestry. DAFF is also developing policies and strategies on (1) Conservation farming, (2) Food security & nutrition and (3) Land care. Agroforestry can contribute to all three initiatives. There is a need to ensure that the alignment of these initiatives is achieved.
- **The White Paper on Sustainable Forest Development, 1997 and The National Forest Act, 1998:** The component of these policies which speaks directly to agroforestry is community forestry and sustainable forestry management. This is a form of forestry that allows the local community to play a role in forest management and land use decision making. It includes farm forests, agroforestry or village planting, woodlots and woodland management. The policy acknowledges that community forestry has been neglected in South Africa, with more emphasis on commercial farm

forestry. The policy seeks to encourage farmers to plant indigenous trees in gardens, fields and in managed plantations.

- **National Greening Strategy, 1996**: Creation of sustainable livable settlements. The strategy supports agroforestry in an urban, town and informal settlement setting. The rolling out of the greening programme indirectly introduces agroforestry in these platforms

- **National Research and Development Strategy, 2002:** this document makes reference to both the agriculture and forestry sectors which allows an opportunity to approach in research in an integrated manner that investigates agroforestry.

- Draft policy on Conservation Agriculture

2 THE STRATEGY FRAMEWORK

2.1 Purpose

Agroforestry is a complex and novel system of farming and requires proper management to maximise positive interactions and minimise negative interactions between the different components of the system. To achieve the full benefits of agroforestry, a supportive environment to develop the correct systems that are locally appropriate is necessary. It is firstly, on this premise that the strategy framework for supporting agroforestry is based. Secondly, the purpose of this document to provide a Strategy Framework that sets out a broad guideline and strategy themes within which Agroforestry can be practiced and implemented in South Africa.

2.2 Vision for Agroforestry

The following is a proposed vision for agroforestry in South Africa:

To achieve the integration and mainstreaming of agroforestry as an accepted land use that contributes to food security, improved livelihoods and income generation while building resilient, climate smart systems that sustain our natural resources.

2.3 Principles of the strategy

1. The principles of drawing on the energies and skills of the South African people, enhancing capacity and developing broad partnerships, as stated in the NDP are supported.

2. In enabling the principle of inclusiveness, agroforestry should consider not only farm-scale systems, but also include agroforestry as part of the broader landscape to contribute to natural resource, forestry and agricultural policy objectives.

3. Agroforestry systems are area and climate specific – it is necessary to develop agroforestry systems that are locally relevant, and must consider the biophysical and socio-economic context (including land tenure) on a case by case basis. Both urban and rural agroforestry systems must be supported

4. Agroforestry should contribute to food, energy and fibre sovereignty

5. Agroforestry means different things to different people – an inclusive approach that recognises traditional systems and indigenous knowledge as a basis for building locally sustainable systems is necessary

6. A bottom up approach that builds on existing agroforestry systems currently being applied in South Africa is necessary – knowledge and decision-making at a local level should be supported. The approach should be developmental rather than a macro-economic focus - build people not GDP.

7. There are 22 000 plant species indigenous to South Africa. Indigenous species that can be applied in agroforestry systems should be identified and developed.

8. The strategy should apply the SMART principles (simple, measurable, achievable, realistic and time-bound) – the strategy should be implementable realistic and have a horizon of 5-10 years.

9. Strategy should focus on systems and supporting people, rather than buying inputs and should have a programmatic rather than project based approach with on-going learning.

2.4 Strategic themes

To achieve the vision of the strategy, three key strategic themes are used as the basis for AF development. These are:

- Policy: creating the *enabling environment for agroforestry*.

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- Knowledge development: developing the *science of agroforestry, demonstrating the benefits and developing the skills of agroforestry.*
- Implementation: *adopting and integrating agroforestry* into the landscape for social and economic benefit.

The interlinked elements of research, policy and implementation should be regarded as an on-going process in developing the agroforestry sector in South Africa. As shown in **Error! eference source not found.** On-going monitoring, evaluation and adaptive management are integral to sustaining the strategy and continued development of the sector. The goals and key actions under each of these themes are provided in Figure 2.1.
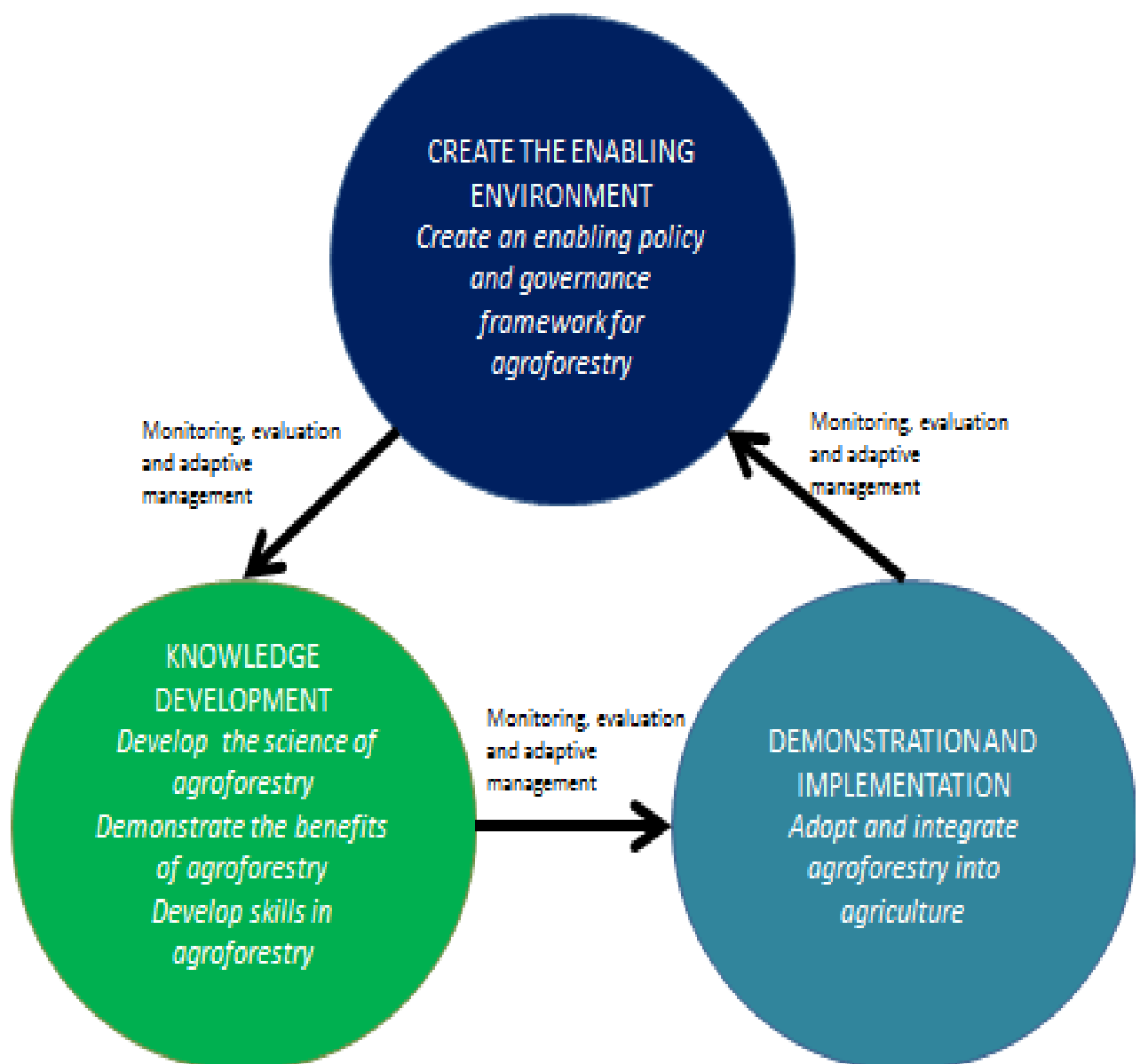
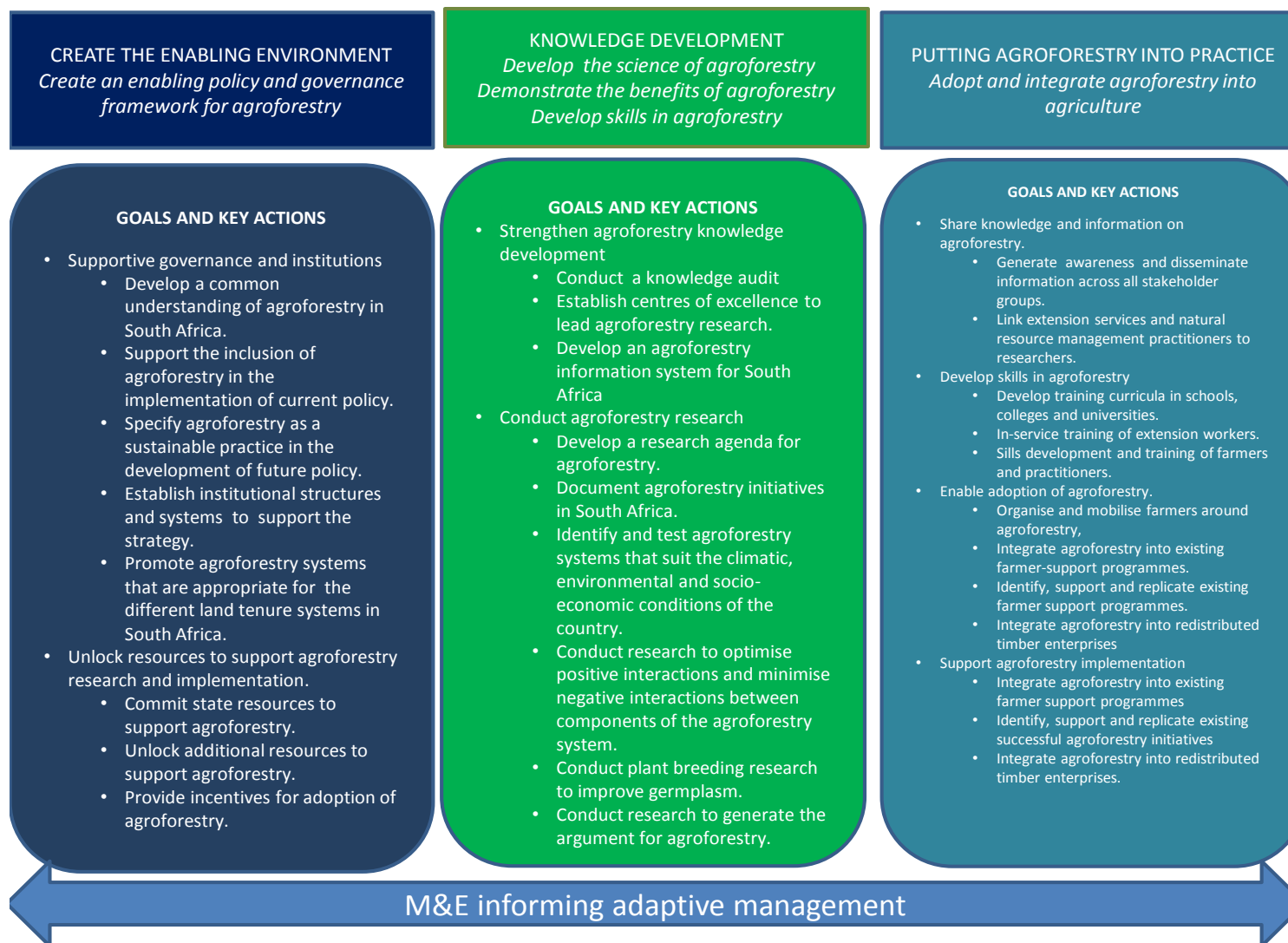Figure2.1 Goals and actions under the thematic areas

CREATE THE ENABLING ENVIRONMENT
Create an enabling policy and governance framework for agroforestry

KNOWLEDGE DEVELOPMENT
Develop the science of agroforestry
Demonstrate the benefits of agroforestry
Develop skills in agroforestry

PUTTING AGROFORESTRY INTO PRACTICE
Adopt and integrate agroforestry into agriculture

GOALS AND KEY ACTIONS

- Supportive governance and institutions
  - Develop a common understanding of agroforestry in South Africa.
  - Support the inclusion of agroforestry in the implementation of current policy.
  - Specify agroforestry as a sustainable practice in the development of future policy.
  - Establish institutional structures and systems to support the strategy.
  - Promote agroforestry systems that are appropriate for the different land tenure systems in South Africa.
- Unlock resources to support agroforestry research and implementation.
  - Commit state resources to support agroforestry.
  - Unlock additional resources to support agroforestry.
  - Provide incentives for adoption of agroforestry.

GOALS AND KEY ACTIONS

- Strengthen agroforestry knowledge development
  - Conduct a knowledge audit
  - Establish centres of excellence to lead agroforestry research.
  - Develop an agroforestry information system for South Africa
- Conduct agroforestry research
  - Develop a research agenda for agroforestry.
  - Document agroforestry initiatives in South Africa.
  - Identify and test agroforestry systems that suit the climatic, environmental and socio-economic conditions of the country.
  - Conduct research to optimise positive interactions and minimise negative interactions between components of the agroforestry system.
  - Conduct plant breeding research to improve germplasm.
  - Conduct research to generate the argument for agroforestry.

GOALS AND KEY ACTIONS

- Share knowledge and information on agroforestry.
  - Generate awareness and disseminate information across all stakeholder groups.
  - Link extension services and natural resource management practitioners to researchers.
- Develop skills in agroforestry
  - Develop training curricula in schools, colleges and universities.
  - In-service training of extension workers.
  - Sills development and training of farmers and practitioners.
- Enable adoption of agroforestry.
  - Organise and mobilise farmers around agroforestry,
  - Integrate agroforestry into existing farmer-support programmes.
  - Identify, support and replicate existing farmer support programmes.
  - Integrate agroforestry into redistributed timber enterprises
- Support agroforestry implementation
  - Integrate agroforestry into existing farmer support programmes
  - Identify, support and replicate existing successful agroforestry initiatives
  - Integrate agroforestry into redistributed timber enterprises.

M&E informing adaptive management

Figure 2.1: Strategy framework for supporting agroforestry development in South Africa

AGROFORESTRY STRATEGY FRAMEWORK FOR SOUTH AFRICA FINAL DRAFT FEBRUARY 2017

The vision, aim and goals listed below have been formulated in order to speak to the key issues identified on the earlier documents and around the strategy framework shown above. Achievement of these goals will ensure that agroforestry is able to achieve the potential benefits that have been identified.

2.5   Towards a working definition for agroforestry in South Africa

Agroforestry systems are not easy to define as they range from communal subsistence livestock silvo-pastoral systems, to home gardens, commercial farm and timber planting operations. Furthermore, agroforestry can be applied in a range of agro-ecological conditions and socio-economic circumstances. Furthermore, the scale at which interactions occur between the components of the system may be at a homestead scale, farm scale, or at a landscape scale. Agroforestry is dependent on the objectives of the system. In some cases, agroforestry is applied for land rehabilitation and the enhancement of ecological services, to diversify crops for risk management, food security, climate resilience or mitigation, or for the commercial production of food, fuel and fibre products. Nevertheless, it is necessary to establish a working definition of agroforestry for South Africa. The proposed definition for South Africa is as follows:

"Agroforestry is a sustainable land management system that deliberately includes woody plants with crops and / or animals within the same land management system resulting in positive socio-economic and / or ecological interactions between the woody and non-woody components; and is applied in manner and scale that is compatible with the local cultural, socio-economic and agro-ecological context."

This definition is designed to accommodate the various socio-cultural and socio-economic contexts that exist in South Africa and allow agroforestry systems to be applied at a local, farm-level and landscape scale. This definition represents a starting point and further improvements to the definition are welcome.

2.5. Strategic Themes and Goals

Theme 1: Creating the enabling environment	
Goal 1.1: Supportive governance and institutions	1.1.1: Develop a common understanding of agroforestry in South Africa
	1.1.2: Support the inclusion of AF as a sustainable land use practice in the implementation of current policies (Agriculture, Forestry and Environment)
	1.1.3: Specify AF as a sustainable practice in future policy development
	1.1.4: Establish institutional structures and systems to support the strategy
	1.1.5: Promote agroforestry systems that are appropriate for the different land tenure systems in South Africa.
Goal 1.2: Unlock resources to support agroforestry research and implementation	1.2.1: Commit state resources (human and financial) to support agroforestry
	1.2.2: Unlock additional resources to support agroforestry.
	1.2.3: Provide incentives for the adoption of agroforestry
Theme 2: Knowledge development	
Goal 2.1: Strengthen agroforestry knowledge development.	2.1.1: Conduct a knowledge audit
	2.1.2: Establish centres of excellence to lead agroforestry research.
	2.1.3: Develop an agroforestry information system for South Africa.
Goal 2.2: Conduct agroforestry research	2.2.1: Develop a research agenda for agroforestry
	2.2.2: Document agroforestry initiatives in South Africa
	2.2.3: Identify and test agroforestry systems that suit the climatic, environmental and socio-economic conditions of the country.
	2.2.4: Conduct research to optimise positive interactions and minimise negative interactions between components of the agroforestry system
	2.2.5: Conduct plant breeding research to achieve germplasm improvement and cultivar development.
	2.2.6: Conduct research to generate the argument for agroforestry
Theme 3: Putting agroforestry into practice	
Goal 3.1 Share knowledge and information on agroforestry	3.1.1: Generate awareness of agroforestry and disseminate information across all stakeholder groups
	3.1.2: Link extension services and other natural resource management practitioners to researchers
Goal 3.2: Develop skills in agroforestry	3.2.1: Develop training curricula in schools, colleges and universities
	3.2.2: In-service training of extension workers
	3.2.3: Skills development and training of farmers and practitioners
Goal 3.3: Enable adoption of agroforestry	3.3.1: Organise and mobilise farmers around agroforestry
	3.3.2: Make seed and planting material available
	3.3.3: Develop markets for agroforestry products
	3.3.4: Provide targeted and long-term extension.
	3.3.5: Identify support and replicate existing successful agroforestry initiatives
Goal 3.4: Support agroforestry implementation	3.4.1: Integrate agroforestry into existing farmer-support programmes
	3.4.2: Identify, support and replicate existing successful agroforestry initiatives.
	3.4.3: Integrate agroforestry into redistributed timber plantations

2.6 Themes, goals and key actions

2.6.1 *Theme 1: creating the enabling environment*

The lack of coordination between the sectors in South Africa results in overlooking the use of Agroforestry as a land use practice to enhance food security, resource conservation and retention or restoration of ecosystem services. There is a great emphasis on commercial agriculture or forestry production systems, which are usually monocultures, whereas in the case of forestry, land users may be reluctant to introduce new crops into their timber. This is often a result of policies often promote certain agricultural systems e.g. Massive food production programmes. Issues relating to insecure land tenure and shortages of land also discourage farmers from investing in agroforestry. It is therefore necessary to create an enabling policy, governance and institutional environment that support agroforestry.

Goal 1.1: Supportive governance and institutions

Objective 1.1.1: Develop a common understanding of agroforestry in South Africa

According to the Food and Agriculture Organisation of the United Nations (FAO), Agroforestry systems include both traditional and modern land use systems in which trees are managed together with crops and/or animal production systems in agricultural settings. However, from the stakeholder engagement meetings, it became clear that there is no common understanding of agroforestry locally. Confusion between mixed farming and integrated farming systems still exist. For example, some stakeholders consider a mixed farming system that includes trees, crops and / or livestock to be agroforestry while, in reality, agroforestry is a combination of trees and crops and / or livestock within a single field. In order to overcome these issues the following specific actions have been identified:

- Review existing agroforestry definitions.
- Review the South African socio-economic and agro-ecological context.
- Establish a definition for agroforestry for South Africa based on the socio-economic and agro-ecological context.

Based on the definitions promoted by internationally recognised organisations that support agroforestry – such as the FAO and the World Agroforestry Centre (previously ICRAF), there are a variety of systems that are all recognised as agroforestry. Key words include: Forests,

land, livestock, communities, crops, sustainable, ecosystems, Indigenous, income, food security, job creation, medicinal. Furthermore, AF should be driven by the concept of food sovereignty which promotes the ownership of the production system and food diversification. The definition of AF should be cognisant of international / classical definitions, but should also consider social, ecological and landscape contexts. Food security is a national policy priority across sectors – AF can make substantial contributions to this.

Considering the various definitions available, we suggest a definition based on the ICRAF definition:

Agroforestry is a collective name for land-use systems and technologies where woody plants are deliberately used on a same land management unit as agricultural crops and/or animals, in some form of a spatial arrangement or temporal sequence. In agroforestry there are both ecological and economic interactions between different components (Lundgren and Raintree 1982.)

Objective 1.1.2: Support the inclusion of AF as a sustainable land use practice in the implementation of current policies (Agriculture, Forestry and Environment)

It has been identified that agroforestry due to its multidisciplinary nature, and multiple benefits is highly relevant to the state Environment, Agriculture and Forestry sectors. In addition, other Departments also stand to benefit (e.g. health, land reform).

Recognising that policy formation can be a drawn out process, and noting that if a policy was required before the strategy could be implemented this would delay implementation, it is suggested that where relevant, AF is recognised as a practice that contributes to policy objectives, even if it is not mentioned specifically. For example, in climate policy (adaptation and mitigation), AF is a climate smart agricultural practice, but is not mentioned specifically. Achieving this objective would require lobbying various Departments to acknowledge AF where it can contribute meaningfully to existing policy objectives.

To work towards achieving acceptance of AF, it is suggested that we reposition the understanding of AF across different departments and sectors and appeal to their interests. This will require ongoing interdepartmental communication and meetings. Furthermore, it is suggested that local examples of AF be documented to describe what AF means in a South

African context and provide detail on how AF is currently being applied in South Africa. This is discussed further in Goal 2: Knowledge development.

Objective 1.1.3: Specify AF as a sustainable practice in future policy development

Considering Objective 2 above, it would still be appropriate for future policies that are established to specifically define and support agroforestry activities. Many programmes that support agriculture, particularly for smallholder farmers or foresters, focus on monoculture systems and as a result, more complex but potentially more beneficial systems such as agroforestry may not be adequately considered in national support policies and programmes.

Recognising that there will be a need to support monocultures, policies need to recognise the multidimensional nature of agriculture and forestry land use systems and allow for alternative and novel systems of production to be supported alongside conventional production systems.

We propose a range of research activities in Goal 2, which will inform the development of policies that will support AF. Thus establishing any policies supporting AF will be a long term process.

Objective 1.1.4: Establish institutional structures and systems to support the strategy

Given the integrated and multidisciplinary nature of agroforestry, it is necessary that institutional support and systems are established. This requires not only intra and interdepartmental collaboration to develop the agroforestry sector, but also engagements and partnerships with NGOs, academia and the private sector.

As a first step, in principle, support for agroforestry and the strategy are required at a national level. It is suggested that with DAFF as lead, in collaboration with other key departments (e.g. DRDLR, DED, DWS and DEA) oversee the support and implementation of agroforestry in South Africa. This will also enhance inter and intra-sectoral collaboration in support of agroforestry.

Subsequently there should be further engagement with key stakeholders who have already been engaged as part of the strategy development process. Institutional arrangements should be designed to support implementation of the strategy and create the space for

funding. An expert working group should be established, with the ultimate vision of establishing an AF community of practice across the country.

Objective 1.1.5: Promote agroforestry systems that are appropriate for the different land tenure systems in South Africa

It is important to be cognisant of the different land tenure arrangements that exist and develop systems to support AF that respond to the requirements of farmers in the different systems. For example, a rural farmer in communal tenure land may have more interest in food security, compared to a farmer on redistributed land who may be more profit focussed. Furthermore, tenure security arrangements (e.g. communal tenure) may limit the ability of farmers to access capital and is a disincentive for the farmer to invest in new farming systems. It is necessary to explore novel tenure arrangements that can allow farmers to invest in agroforestry.

The timber sector is characterised by a situation where farms claimed through the land reform process have not retained their prior level of productivity. One of the reasons is that claimants have differing opinions about how to use their land/ some may wish to be able to keep livestock or grow other crops. Agroforestry could allow for the integration of other enterprises into existing timber-based farms, without the total change in land-use and reduced contribution of fibre to the industry.

Goal 1.2: Unlock resources to support agroforestry research and implementation

Objective 1.2.1: Commit state resources (human and financial) to the process of supporting agroforestry.

To develop the agroforestry sector, it is necessary to secure funding sources for agroforestry research and development. Funding partnerships to support agroforestry (e.g. with research institutions and DST) should be established to develop research and development programmes for agroforestry. In addition to this, support for agroforestry development should be included in state budgeting processes. This should also aim to unlock funding for research, education, training and skills development around AF. Dedicated staff should be allocated to oversee and support the implementation of agroforestry in South Africa.

Objective 1.2.2: Unlock additional resources to support AF

It is recognised that the state alone cannot support the full suite of activities to support AF development. Building on the correct institutional arrangements to support AF, State resources should be used to mobilise other sources of funding to support AF. These would include private sector commitments, regional grants (e.g. SADC, AfDB) and other incentive programmes (e.g. REDD, Carbon sequestration, carbon credits, etc).

Objective 1.2.3: Create incentives for adoption and partnerships

Incentives for adoption of agroforestry should be developed – these could include rebates, tariff exemptions and other mechanisms that would support agroforestry development. This is particularly applicable where partnerships between large scale commercial and small-scale / emerging farmers can be supported. Actions that support economic transformation, especially of youth should be supported.

2.6.2   Theme 2: knowledge development

There has been limited agroforestry research in South Africa. Research is also motivated by the availability of funding. Therefore the development of agroforestry research in South Africa depends on the development of a comprehensive AF research programme and funding to support the research.

Goal 2.1: Strengthen AF knowledge development

Objective 2.1.1: Conduct a knowledge audit

There has in the past been substantial research into AF systems in South Africa. Furthermore, there are a number of recognised agroforestry experts in academia, government and the private sector. It is necessary to understand what has already been learnt about AF, before proceeding with developing new knowledge. An audit of current knowledge of AF in South Africa is a necessary starting point and a knowledge audit that reviews, summarises and catalogues previous AF research through searching various state and university libraries is required.

Objective 2.1.2: Establish centres of excellence to lead agroforestry research

Centres of excellence should be identified and established as lead research agents in agroforestry systems. These may include universities, agricultural colleges, forestry colleges, research stations and state research agencies (e.g. ARC). It is suggested that a number of centres are established and provided with funding for agroforestry research. The geographic location of these centres should reflect the different agro-ecological zones (AEZ) that occur in South Africa and the research focus should be on systems best suited to the AEZ in which the centre is located. The state should provide seed funding for research and assist the centres with securing funding from other sources (.e.g. Water Research Commission, SADC funding mechanisms, etc.). The centres of excellence should conduct technical, social, environmental and economic elements of AF, with a particular focus on shared learning and participatory action research.

Objective 2.1.3: Develop an agroforestry information system for South Africa

In order to share and disseminate information on agroforestry (see Theme 3: demonstration and implementation) it is necessary to have a centralised system of gathering and collating information. Building on the research activities conducted, it is recommended that the centres of excellence are responsible for developing a knowledge management system for the collation and dissemination of AF knowledge. Key elements of the database should be developed in consultation with DAFF, natural resource professionals and farmers.

Goal 2.2: Conduct agroforestry research

Objective 2.2.1: Develop a research agenda for agroforestry

In consultation with DAFF and associated state actors, and recognised AF experts, a research agenda for agroforestry should be developed. Agroforestry has a transdisciplinary and integrated nature; therefore an integrated approach to developing the research agenda is recommended. The agenda should include plans for securing and ring fencing funding for AF, pursuing global collaborations (e.g. World Agroforestry Centre, AF practitioners in India and South America) to address gaps from different role players.

Objective2.2. 2: Document agroforestry initiatives in South Africa

It is critical that locally developed or applied AF systems are documented – indigenous knowledge systems that use AF as well as endogenous systems that are currently working in South Africa are most likely to be suitable for upscaling and outscaling. Furthermore they would have developed under the unique socio-economic context of South Africa, meaning that they are more likely to be sustainable. Through the literature review and stakeholder engagements, a number of current AF activities have been identified and have been included as an initial database. These initiatives and others that are identified through further investigations should be documented in detail to provide case studies for promoting AF development in South Africa.

Objective 2.2.3: Identify and develop agroforestry systems that suit the climatic, environmental and socio-economic conditions of the country

Due to limited agroforestry research and practice in South Africa, we often refer to the agroforestry systems presented by the international literature. These systems have been developed, tested and adopted by other countries based on their climatic and biophysical properties. Therefore there is a need to develop systems that will suit the climatic, environmental and socio-economic conditions of South Africa. Beginning the documented AF from objective 2, additional research should be conducted to identify suitable species combinations for different agro-ecological zones and social-economic contexts.

Objective 2.2.4: Conduct research to optimise positive interactions and minimise negative interactions between components of the agroforestry system

South Africa is a water stressed country, as a result breeding research is concentrated at breeding varieties that can withstand the harsh climatic conditions such as drought and water stress. Currently, little research has been conducted in South Africa on the best combinations and practices for AF. Because AF introduces competition between the canopy and understory components, the best spatial and temporal arrangements need to be identified for optimal production.

Objective 2.2.5: Conduct plant breeding research to achieve germplasm improvement and cultivar development

Many popular Agroforestry species are either not allowed, in terms of the Conservation of Agricultural Resources Act (CARA), or are erratic in their production characteristics. There is a need to identify and evaluate most promising high value agroforestry species. There has been little work to improve the quality of indigenous species (such as *Sesbania sesban*) for use in Agroforestry. Agroforestry species growth and productivity may be relatively low and variable, often owing to lack of access to better-quality germ-plasm. Seed collection, propagation and multiplication methods, as well as vegetative propagation, are poorly known, and advanced propagation methods are not available. There is therefore a need to develop improved cultivars that produce consistently and of high quality.

Objective 2.2.6: Conduct research to generate information for the justification of agroforestry

There are various socio-economic barriers to the adoption of agroforestry. These include a lack of market for products from new or novel agroforestry species, perceptions of high initial capital and labour costs, and delayed returns on initial investments (particularly in timber plantations). Furthermore, there are management challenges associated with integrating trees and shrubs into cropping systems (and integrating crops into forestry systems). Building a sound economic argument to support agroforestry is necessary.

2.6.3 Theme 3: Putting agroforestry into practice

Goal 3.1 Share knowledge and information on agroforestry

Objective 3.1.1: Generate awareness of agroforestry and disseminate across all stakeholder groups

A lack of awareness of the benefits of Agroforestry exists across different sectors in South Africa. There is overdependence on conventional agricultural methods and hence farmers lack interest in pursuing sustainable agricultural methods. Professional advisors, policy makers and farmers have a negative perception towards agroforestry for a variety of reasons including different labour requirements, unestablished markets and local beliefs, while failing to identify benefits that agroforestry can offer. Furthermore previous AF research has not been transferred to extension services or to the farmer.

Most of the South African AF research initiatives focused mainly on investigating the potential of the technology for improving water use efficiency. While this element is important

in a national context, more focus on how these systems directly benefits is required, because if a farmer does not perceive value from the system, it will not be adopted. Thus Agroforestry needs to be considered from an environmental (e.g. water and climate), economic (e.g. income and labour) and a social (e.g. livelihoods and food security) perspective if wider adoption is to be achieved.

There is therefore a need to provide information about agroforestry in terms the benefits and different systems that are available and devise innovative approaches to promoting AF. Guidelines and best practices information should be shared among stakeholders. This should include extension services, development practitioners and natural resource professionals.

Objective 3.1.2: Link researchers to extension services and other natural resource professionals

Platforms that link researchers with extension services are important for sharing information. Events such as farmers' days, conferences and symposiums, peer to peer sharing and publications (journal and popular articles) should be supported. Furthermore, institutional arrangements proposed in Goal 1.2 should support the establishment of information sharing networks to ensure that information is provided to farmers in a way that is accessible.

Goal 3.2: Develop skills in agroforestry

Since this technology is new in the country professionals need to be educated and trained, to improve awareness, and enhance researchers' interest in pursuing agroforestry research and support extension practitioners to implement AF systems. There is a need to develop a local knowledge base of agroforestry.

Objective 3.2.1: Develop training curricula in schools, colleges and universities

Linked to the research theme and also to develop the necessary skills to support agroforestry in South Africa, it is necessary to develop training curricula for professionals and practitioners in agroforestry. This should include formal education, (schools, colleges and universities), short courses and training modules focussed on farmers.

Objective3.2. 2: In-service training of extension workers

The lack of transfer of information between researchers and extension officers- and ultimately farmers, is widely recognised. In order for agroforestry information to reach farmers, there is a need to ensure that researchers package their findings in a way that can be used by extension workers and then for farmers. It is suggested that a farmer field school approach be applied where researchers and AF specialists provide training to extension workers and capacitate extension to provide these skills to farmers.

Objective 3.2.3: Skills development and training of farmers and professionals

Associated with the in-service training of extension workers, training courses should also be provide to farmers, NGOs and organisations supporting AF. This should include capacitating officials involved in farmer support programmes, such as Land Care and environmental officers involved in the DEA Natural Resource Management Programme.

Goal 3.3: Enable adoption of agroforestry

Objective 3.3.1: Organise and mobilise farmers around agroforestry

To effectively provide support and increase uptake of AF practices, it is necessary to make use of existing structures to organise and mobilise farmers around agroforestry. There are a variety of organisational arrangements that farmers can rally around. These may farmers associations which usually have a geographic focus, or they can be around a specific commodity where grower structures are in place. These structures should be used to mobilise farmers and it is suggested that farmers currently involved in AF practices should be mobilised first.

Objective 3.3.2: Make seed and planting material available

The acquisition of planting material of the Agroforestry species is a challenge in South Africa because they may either be invasive or not available in the country. Other species are affected by lack of research which results in poor quality germplasm. These factors can limit farmers adoption as they are not able procure the inputs (mainly seed) necessary for AF. Farmers must have access to planting material if they are to be able to adopt agroforestry

practices. Nurseries and seed companies should also be support to propagate and supply AF species to farmers.

Objective 3.3.3: Develop new markets for agroforestry products

The introduction of new and novel agroforestry crops will require that new markets for these commodities are explored and developed. Building on the information gathered from research, market assessment and development should be conducted. This should include identifying markets for existing AF products (e.g. Pigeon pea / dhal) and finding markets for new and novel AF products (e.g. Moringa)

Goal 3.4: Support agroforestry implementation

Objective 3.4.1: Integrate agroforestry into existing programmes

There are a number of programmes that can already contribute meaningfully to Agroforestry. These include Land Care, Permaculture, Environmental Programmes, Food Security interventions and informal Agroforestry practices at farm level. Some private sector companies and NGOs are already engaging in Agroforestry, and it is not easy to identify these initiatives due to lack of coordination between sectors.

Objective 3.4.2: Identify, support and replicate existing successful agroforestry initiatives

If AF is to be adopted, evidence of the benefits of AF should be realised locally. Lack of evidence on the ground could leave room for more doubts about the potential benefits of the AF practises. Building on the case studies of local AF practices, extension and training support should initially cluster around existing successful agroforestry practices and upscale these locally (i.e. among neighbouring farmers). At the same time, success stories of early adopters should be documented and shared along with cost-benefit analyses of adopting the technology. Once local upscaling has been achieved, efforts should focus on introducing the practice to new communities in a different geographic area.

Objective 3.4.3: Integrate agroforestry into redistributed timber enterprises

A specific focus is suggested to support agroforestry in redistributed timber enterprises. Adopting AF in timber production provides opportunities for short term income with the

understory crops, while also securing long-term income from the timber production. It is suggested that a number of pilots are developed in the timber growing regions of South Africa.

2.6.4 *Theme 4: Monitoring, evaluation and adaptive management*

On-going monitoring, evaluation and adaptive management to inform research, the enabling environment as well as supporting the development of agroforestry are necessary. A monitoring framework is included as part of the strategy implementation plan for the strategy, which identifies a set of indicators against which progress in developing the AF sector can be assessed.

3   IMPLEMENTATION PLAN

Implementation plan is attached as Appendix 1

4   MONITORING AND EVALUATION

Monitoring and evaluation will be conducted to assess whether the following goals of the strategy have been achieved:

- Development of common understanding of agroforestry

- Establishment of pilots in identified sites

- Establishment of centres of excellence to lead agroforestry research

- Generate awareness about agroforestry and dissemination of information to stakeholders

- Organize and mobilise farmers around agroforestry

- Develop manuals and guidelines on agroforestry