IFC: Pilot Programme for Climate Resilience (PPCR)

Private Sector Support to Climate Resilience in Zambia

March 2013

For public release

pwc

Executive Summary

NB: Names of institutions, companies, projects and products in the report have been replaced with letters e.g. Company A, B, C or Product 1, 2 3 in order to maintain confidentiality of the entities, projects and products involved.

The challenge

Severe weather events are already restricting Zambia's economic development and posing food security challenges. Future climate change impacts are likely to exacerbate the situation[1]. Smallholder farmers, which make up the majority of the population, are some of the most vulnerable, and will be the hardest hit and therefore need the greatest support to build their resilience.

Traditional farming practices typically involve subsistence cultivation of maize in a largely mono-cropped system. Annual burning of crop residues during field preparation, coupled with limited access to fertilizers (both organic and inorganic) results in depletion of soil nutrients. As yields decline, farmers are forced to open up new farm plots, often by clearing forest areas.

The biophysical resilience of this type of farming system to climate change impacts such as floods and drought is limited. During heavy rains and floods, soil erosion can be high. And as organic matter in soils depletes, and fields left bare after burning, the water holding capacity of soils is reduced, making the system particularly vulnerable to droughts. In the face of these challenges, farmers face increasingly negative variability in yields. This is a key factor driving many rural households to resort to unsustainable short term coping strategies, such as forest degrading charcoal production.

In addition to degrading valuable ecosystem services, unsustainable land management practices are a significant source of Green House Gas (GHG) emissions through the degradation of carbon stocks in forests and farm soils.

The solution

In the face of these challenges, we consider that the scaled adoption of 'climate-smart' agriculture (CSA) amongst Zambia's smallholder population will be critical to build Zambia's resilience to climate change. Practices such as conservation agriculture (including reduced tillage, use of cover crops, and use of legume rotations), agro forestry (especially the use of nitrogen fixing species), and 'evergreen' agriculture (a combination of both), have the potential to significantly increase yields and enhance the biophysical resilience of smallholder systems. By sustainably increasing soil nutrients, reducing susceptibility to soil erosion, and increasing the water holding capacity of soils, the need to shift agricultural plot every 2-5 years is removed, and reliance on short term coping strategies such as charcoal production reduced. CSA practices can therefore lead to significant mitigation co-benefits, both on farm, through sequestration of carbon in trees and soils, and off-farm, by addressing the underlying causes of deforestation and forest degradation.

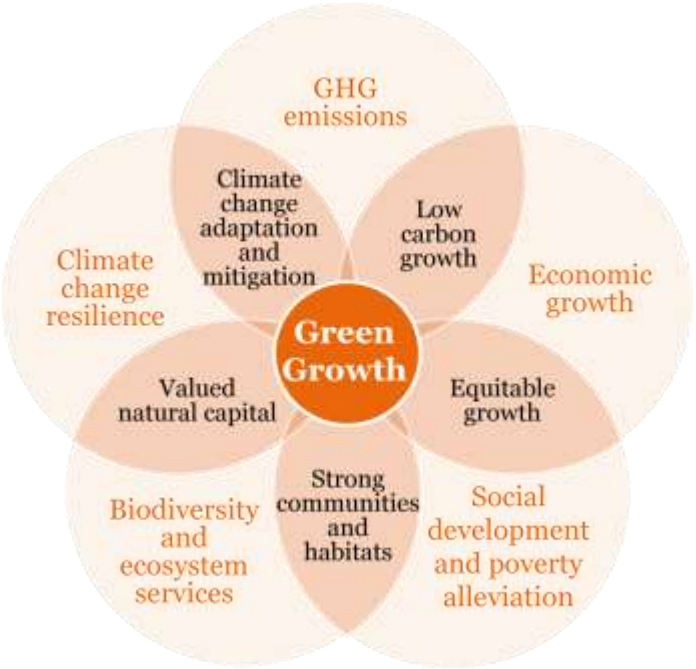
However, the CSA opportunity for smallholder farmers is limited by a number of barriers including a lack of access to: technical assistance; markets (to buy 'climate-smart' inputs and sell surplus produce); start up finance; and risk mitigation mechanisms such as micro-insurance.

This study has identified a suite of complementary interventions that can be implemented in conjunction to overcome these barriers, support the efficacy of an overall REDD+ project, and achieve the multiple dimensions

[1] Appendix A.7 Zambia Development and Climate Risks

of green growth at a landscape level (see **figure 1** below). Five of the key interventions and their respective synergies are summarised below.

Figure 1: Objectives of Green Growth



Source: PwC

1. 'Climate-smart' Agriculture - smallholder soya /nitrogen fixing trees

This intervention involves providing groups of smallholder farmers with technical assistance in the adoption of 'climate-smart' soya production, and access to markets for sale of surplus produce to large agro-processors.

Soya is especially well suited to production in 'climate-smart' systems. When grown in a 'double-up legume' system alongside maize and other legumes such as pigeon pea, yields can improve significantly supporting food security objectives. The strong market for soya in the region, presents an opportunity to formalise the engagement of smallholders in agro-processor supply chains through provision of off-take agreements for produce, and in turn to underpin access to finance interventions with commercial lenders. Soya production also presents an opportunity to test and refine the design of weather indexed micro-insurance products being developed under a complementary work-stream to this IFC PPCR scoping study.

Scaling 'climate- smart' soya can also deliver mitigation co-benefits, directly through sequestration of carbon in on farm perennials and soils, and indirectly by removing the need for smallholders to shift agricultural plots every 2-5 years often into forest areas. It therefore holds significant potential in the context of a larger REDD+ sustainable landscape concept.

2. Access to finance (A2F) intervention

This intervention involves linking smallholder farmers to commercial providers of working capital and asset finance, to overcome associated 'start up costs' in 'climate-smart' production methods. The intervention, presents an opportunity to align the interests of key private sector actors (i.e. commercial banks, agro-processors) with smallholder farmers in achieving sustainable and improved methods of production. This in turn will help catalyze provision of technical assistance and climate-smart inputs (i.e., high quality seeds, irrigation systems) to smallholders.

Successfully linking smallholders to sources of finance will be integral to scaling the 'climate smart' smallholder soya and agro processing/indigenous food production interventions.

3. Agro-processing / indigenous crop production

This intervention involves investment in agro-processing stations for indigenous crops and farm products produced by smallholder farmers adopting 'climate-smart' production. The development of such stations could provide a critical route to market for smallholder farmers, at improved prices and volumes.

Many of the indigenous crops that would be demanded by these stations (i.e. pigeon pea, groundnut, and indigenous vegetables), have significant potential when grown in climate-smart systems. It also offers opportunities for smallholders to engage in irrigated production methods, during the dry season.

There are clear synergies through integrating this intervention with the A2F and 'climate-smart' soya intervention. For example, it could be possible to use the same networks for technical assistance (TA) provision to smallholders, while start up loans will be needed to access inputs (i.e. seeds, irrigation technologies etc).

4. REDD+ at a landscape level

When adopted in combination, the above interventions will address some of the key proximate and underlying drivers of deforestation prevalent in Zambia. There is an opportunity therefore to target their implementation to support a larger landscape level REDD+ project concept, working closely with local communities in a participatory manner.

Developing a REDD+ project that accounts for the emission reductions of GHG achieved from avoided deforestation and forest degradation activities, and also through adoption of 'climate-smart' agriculture systems in the wider landscape, could provide a pioneering and transformational 'proof of concept'.

Given the absence of any existing 'landscape' level REDD+ projects globally, upfront investment will be required in innovative landscape level accounting methodologies, and data collection systems to support monitoring, reporting and verification of mitigation impacts. However once developed, additional carbon (or payment for ecosystem service) revenue streams could provide complimentary funding to support wider community development projects, provision of agricultural TA services, and general park management activities. While carbon market financing opportunities could be limited to voluntary sector in the short run, alternative public sector performance based funding mechanisms (i.e. BMZ's REDD Early Movers programme[2]) could potentially provide alternative financing options to support such a proof of concept.

Potential geographic sites for development and implementation of such a project could include Kafue National Park and the bordering GMA areas, and Sesheke region in Western Province.

5. Natural Capital land – Natural Resource Management (Tourism and Wildlife)

Zambia is rich in Natural Resources/Natural Capital, not only home to nineteen national game parks which span 30% of the country but also to extensive pristine open areas across the country. These areas provide

[2] www.bmz.de/en/publications/topics/climate/FlyerREDD_lang.pdf

valuable eco-services to the nation, and provide the potential to generate income from tourism and wildlife land use.

However Zambia has not managed to realise this potential in a manner that is sustainable and equitable. As noted by the Natural Resources Consultative Forum[3] in Zambia, natural resources in Zambia are approaching "catastrophic decline: fish, wildlife, and forests disappearing at an alarming rate". The impact of this is a reduction of biodiversity, which results in a reduced amount of organic matter being recycled into soil, and consequent reduced nutrients and water retention capacity.

Assuming the focus of any future implementation is on agricultural and REDD+ interventions at a landscape scale, there needs to be careful planning on how these interventions can be developed to support the biodiversity of the area, and implemented in way that is relevant to and participatory in nature with the local communities . This includes, implementing in context that is relevant to local agriculture, aquaculture or natural challenges and opportunities; not encouraging additional encroachment into protected areas (GMA's), or increasing the risk of human/wildlife conflict.

It is in this context, that we propose that integrated land use planning and a holistic, participatory method of engaging with communities will be critical to success. It is critical to align land use in vulnerable areas (including those in and around national parks) to drive protection of the ecosystem. These include the REDD + landscape project, consumptive and non-consumptive, and climate smart agricultural interventions. We consider how the IFC could support the development of an enabling investment climate to encourage commercial organisations to invest in the area in a manner that is sustainable and beneficial to the local communities. There may be opportunity for some of these investments to be facilitated via the PPCR fund or by other funding mechanisms.

Private Sector Engagement

This project has a specific focus on private sector investment that builds climate resilience, in particular to identify the willingness of the private sector to invest into opportunities that deliver climate change resilience benefits – and to assess the capacity of the private sector has to engage with these opportunities or what support may be required from the IFC. When engaging with the private sector, it was noted that these were not necessarily key investment focus areas of local, regional or international businesses who work in Zambia. For example, agricultural finance typically focuses on commercial farmer concerns and it is perceived that that there are far greater returns in this agricultural segment. Most banks saw engaging with small holder farmers as a form of corporate social responsibility (CSR) rather than a commercial investment.

Large scale commercial entities in Zambia (energy, mining etc), are focused on ongoing operational and service delivery concerns, and did not readily engage when approached by the project team. The larger international tourism concerns in Zambia, are focused on the business client sector of the market, and raised concerns about investing in tourism in Zambia.

Across all sectors, general themes and concerns about the investment climate in Zambia were raised, and the consensus was the investments discussed within the context of this project, may be of more interest to the private sector if a more enabling business environment existed. Typical concerns, which impacted on agricultural and natural capital investments in particular but are crossing cutting, included:

- Doing business in Zambia is seen to be slow, bureaucratic and with processes and regulations that hinder rather than encourage enterprise. It was argued that legislation in place and relevant bodies installed to engage with the sectors should be reviewed to drive economic growth and integrated planning with the private sector – rather than businesses attempting to respond reactively to government legislation when making investment decisions.

[3] Natural Resources Consultative Forum, Observations on the Safari Hunting Industry in Zambia

- *Land tenure*. Much of Zambia's land is not titled and held under the customary tenure system by local chiefs. This system makes it difficult for both businesses and local communities to commercialise as it is not considered collateral. There is opportunity to use current legislation and community engagement to indicate who is responsible for the land – via a formalised agreement of rights and responsibilities of the land. However, there is not an agreed consistent approach and this lack of land security is a barrier for large scale agricultural investors to invest in small scale or community agricultural investments

- *Natural resources*. Both consumptive and non-consumptive tourism investments are typically restricted in time (leases for hunting and tourist investments are typically only for 10 years), subject to more regulation than other business opportunities and subject to additional cost (for example wildlife ownership licences). This results in few large scale, long term investments in the sector – with investments being at risk of being treated as short term, structured to extract maximum profit in minimum time – which can have seriously negative impacts on the management of natural resources.

- *Marketing and branding*. It was noted by several stakeholders, that IFC could play a strong role in making Zambia more marketable internationally. Branding in Zambia is critical to raise market value – and the IFC could potentially invest in facilitating introduction of branding and franchise opportunities to Zambia across the Agriculture and Natural Capital sectors. The advantages of this would be to introduce minimum standards, familiarity and a link between socially responsible business in Zambia and the international market. An example of this happening already is beeswax, from a company R project being sold under an international skincare brand.

Across all sectors there was interest in the IFC working with the government to drive change and support Zambia becoming a more attractive investment destination, which could then drive up investment in commercial opportunities that realise climate change adaptation benefits.

In terms of this project, the following private sector companies or partnerships have indicated interest in the interventions and investments proposed.

Company	Intervention	Investment Interest	IFC requirement	Comments
Company A	Access to Finance	To run a climate resilient loan scheme for smallholder farmers	Risk share	In line with its corporate strategy and interested in talking to IFC
Company D	Access to Finance	Interested in providing technology to support mobile payment of loans	Startup capital for project with bank.	Interested in talking to the IFC
Company H	Climate Smart Agriculture	Off take soya from smallholders	Financial facilitation of scheme	Have indicated initial interest
Company AH	Climate Smart Agriculture	Community lease of land with commercial farming methods		Interest TBC – but have indicated interest to talk to the IFC
Company L/Company AF	Climate Smart Agriculture/Energy	Planting nitrogen fixing trees on cotton farms. Using cotton agricultural waste for biomass briquettes (charcoal alternative)	1. Finance partner to fund carbon asset development and build rural farm capacity 2. Debt/Equity investment to manufacture household energy products	Keen to talk to the IFC
Company I/Company S	Climate Smart Agriculture/Agro Processing	Company I to source and process soya/sunflower for processing from	Funding to support start up and running of programme (up to $US 4 million)	Keen to talk to the IFC

		smallholders		
	Agro processing	Driving Transformation in the Zambian Honey Supply Chain	Apiculture opportunities	Keen to talk to the IFC
Company E	Agriculture	Extension services, Agri-science and capital investment	Interested in supporting Access to Finance	Keen to talk to the IFC
Company U	Agro Processing	Looking to invest in a pulping processing factory. At feasibility study stage.	Interested in co-capital investment	Interested in talking to the IFC.
Company N/Company Q	Agro Processing	Centralised agro-processing plant for company N	1. Startup capital for processing plant 2. IFC Advisory Services – strategy development and Investment 3. Access to international Branding/ Marketing	Keen to talk to the IFC
Stakeholder C/ European private sector investor	Wildlife land use	Game ranch – community conservancy with private sector investor in a depleted GMA (interested in replication nationally if accepted by Zawa)	Startup capital and percentage of community shareholding	Interested in talking to the IFC, if current concession tender is accepted.
Stakeholder D	Wildlife land use	Game Ranching. Private –Community Joint Venture model	Startup capital and community shareholding	Keen to talk to IFC
Stakeholder E	Wildlife land use	Game Ranching, Private –Community joint venture model	Startup capital and community shareholding	Keen to talk to the IFC
Company O	Agro Processing	Three line agro-processing plant located close to smallholder farmers	1. Start up 2. capital for processing plant 3. IFC Advisory Services – strategy development and Investment 4. Access to international Branding/ Marketing	Keen to talk to the IFC
Company AI	REDD + landscape project	Currently setting up REDD+ supporting projects	Looking for IFC loan/development finance for project validation period, with an offtake agreement with the world bank after the two year validation period.	Keen to talk to IFC
Company W	REDD + landscape project/Integrated project	Have been approached by World Bank Carbon project to run a hydro carbon emissions programme. Interested in using revenues raised to support this project	Looking to support the interventions within this program	Keen to talk to the IFC
Company AJ	Non consumptive	Start up venture	Interested in support for	Interested in talking

	tourism/safaris	supported by international finance.	tourism operators on Law Enforcement (grant to support part of this activity has been offered Panthera)	further to the IFC
Company AK	Consumptive tourism	Interested in a private/community business model – with revenues being directly shared between community and private investor.	Looking for IFC funding to support developing the business model, business skills capacity building for the community and start up investment.	Keen to talk to the IFC
Company V	REDD+ Landscape project	Sesheke REDD+ project.	Looking to start up a REDD+ project in the Barotse sub basin (Sesheke)	Keen to engage with the IFC
Company AL	Private Sector Engagement	Engage with private sector companies to delivery natural resource programmes.	Interested in exploring whether they can link their programme with the IFC PPCR work	Interested in talking to the IFC
Company AM	Private Sector Engagement	Company AM engages with private sector to support communities to engage with value chains (in particular rice, apiculture and livestock)	Interested in exploring whether they can link their programme with the IFC PPCR work	Keen to talk to the IFC

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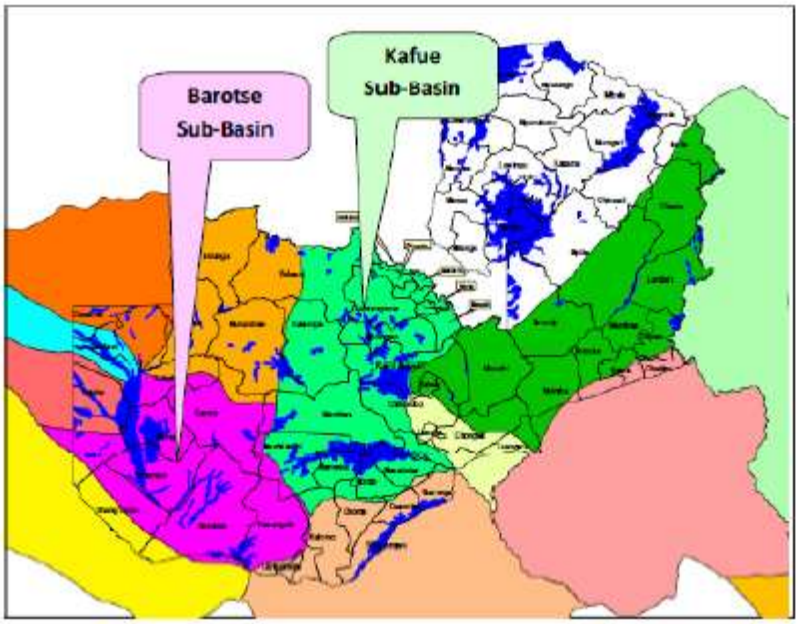
1. Climate Change Impacts in Zambia

Zambia is a landlocked country in Southern Africa with a population of ~13 million people. Frequent droughts, floods and climate variability have greatly hampered Zambia's economic development. Over the past three decades, floods and droughts have cost Zambia ~US$ 13.8 billion (0.4% of annual economic growth) and negatively affected 9 million people. Over the next decade, rainfall variability alone is expected to keep an additional 300,000 Zambians below the poverty line and cost the country ~US$ 4.3 billion in lost GDP, reducing annual GDP growth by 0.9%[4]. Climate change is likely to exacerbate this situation with climate variability and extreme events such as droughts and floods becoming more frequent and intense. Unless adaptation measures are put in place, climate change is likely to increase the risk of famine, increase the spread of disease, decrease the availability of potable water and potentially cause social collapse in vulnerable rural areas. Climate change therefore has the potential to severely undermine the strong growth (an average of 6.4% a year) in GDP that Zambia has experienced over the last 5 years. The country is on the great plateau of Central Africa, at an average altitude of 1,200 metres. The lower parts of the plateau (dambos) have a reliable supply of water during the dry season. They are flooded in the rainy season.

Zambia is high plateau, deeply entrenched by the Zambezi river (and its tributaries, the Kafue and Luangwa) and the Luapula river. The Zambezi flows to the south, turning east to make the border with Zimbabwe and then flowing into Mozambique. In the north are three great lakes, the Tanganyika, Mweru and Bangweulu. Lake Kariba stretches along the southern border. The Mafinga Mountains form part of a great escarpment running down the east side of the Luangwa river valley. The country rises to a higher plateau in the east.[5]

As described in the Zambia PPCR Strategic programme, the Zambezi basin (within which the Barotse and Kafue sub-basin's sit) is both vulnerable to climate variability, in particular floods and droughts as well as being populated by a rural community who are isolated socio-economically.



Kafue and Barotse sub-basins

Zambia has three distinct seasons, with rainfall being influenced by both the El Niño Southern Oscillation (ENSO) – which bring drier than average conditions in Zambia and the south and the reverse with the La Niña.

4 Thurlow, J., Zhu, T. and Diao, X. 2009. The impact of climate variability and change on economic growth and poverty in Zambia. IFPRI Discussion Paper 00890, International Food and Policy Research Institute, Washington.
5 http://www.fao.org/ag/AGP/AGPC/doc/Counprof/zambia/zambia.htm

Variability in the movement of the Inter – Tropical Conversion Zone (ITCZ) also affects Zambia leading to variability in rainfall:

- Hot-dry season – 26 - 38 ºC(mid August to November)
- Rainy season – 27 – 34 ºC (November to April)
- Cool dry season – 13 – 26 ºC (April – mid August)

The country is divided into three (or four including subcategories) main agro- ecological regions. The regions are categorized by precipitation pattern, altitude, quality of soil and crop suitability.[6] They are a composite of 36 agro-ecological zones.

Typical annual precipitation patterns for each region are defined as follows:

Region I –less than 700 mm.

This region is semi arid and drought prone, spans Luangwa Lunsemfwa, Zambezi valleys, Senanga and the Sesheke low altitude plateau areas in the south and south west. This is a high temperature, high evaporative loss and short growing season. "The main soil limitations in this region include severe wetness problems, salinity/sodicity and heavy textured nature making workability (in wet and dry states) difficult. Drought and short growing period reduces the choice of crops to be viably grown, especially by small scale farmers, and leaves the environment delicate."[7]

Farming is focused on bulrush millet, sorghum and livestock[8], and there are food security issues in this area.

Region IIa 800 – 1000 mm & Region IIb 800 – 1000mm

The region includes the entire plateau stretching from Eastern through Central and Lusaka Provinces to the Western Province and also covering Southern Province. Region IIb consists of the Kalahari sands area.

Region IIa, is more productive and key crops include sorghum, maize, groundnuts, cow peas, tobacco, cotton, sunflower, irrigated wheat and horticultural crops.

Region IIb, is the aggraded Western plateau with significant areas of infertile coarse sands – key crops include cassava, bulrush millet, bambara nuts, some maize. In the flood plain, rice and maize are grown.

The soils of Region II are characterized by strong acidity, low nutrient retention and low water holding capacity, dominance of coarse textured topsoil's (abrupt textural change) and severe topsoil capping which results in seedling emergence problems.

Region III – 1000 – 1500 mm

This region is the highest rainfall area. It covers the Northern, Luapula, Copper belt, North-Western and part of Central Provinces. Annual rainfall ranges from 1 000 to 1 500 mm.

The high rainfall areas of Zambia generally have highly leached soils and are characterized by very strong acidity, severe aluminium toxicity, low nutrient reserves and low nutrient retention capacity. Leaching thus

[6] FOSZ, 2001,
[7] http://www.fao.org/docrep/003/x6611e/x6611e02f.htm
[8] Country Pasture/Forage Resource Profiles, FAO

leaves the soil lacking in most major and some minor nutrients. Key crops include finger millet, beans, cassava, maize, sunflower, coffee, tea, tobacco, irrigated wheat and soybeans.

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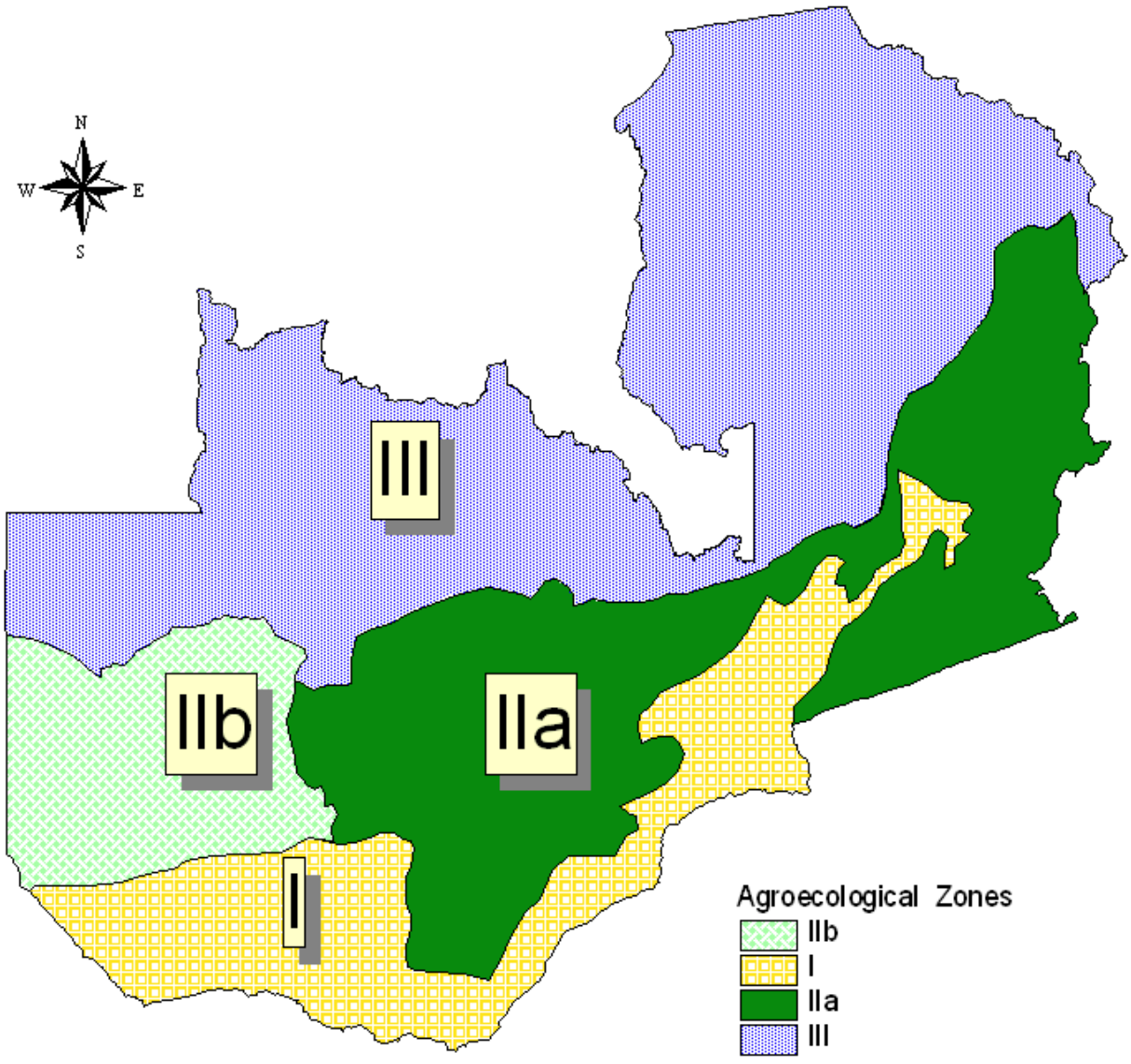

Cassava and maize remain the staple food for most households, with over 90% of households across the country growing maize (whether the land is suitable for maize or not), and cassava which is traditionally seen as 'famine

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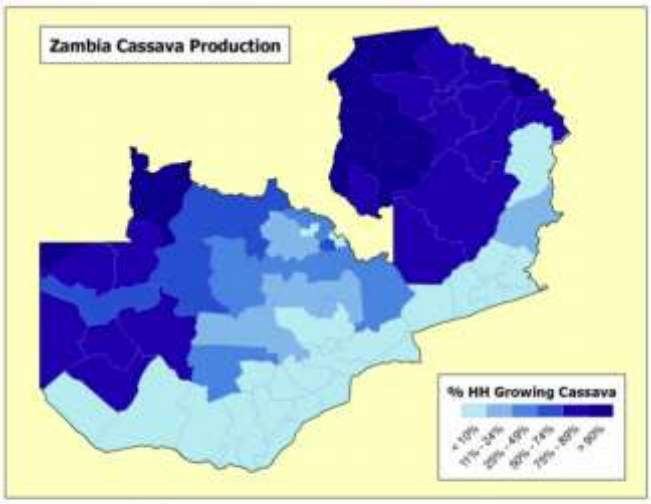
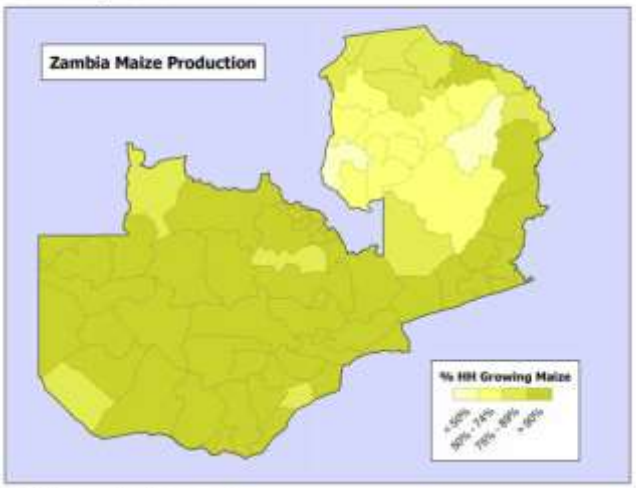
food' in Zambia is grown by a significant number of households. It is significant to note that the Western province which has the most difficult soil to farm successfully has one of the highest rates of Cassava growing - as seen in the diagrams below:



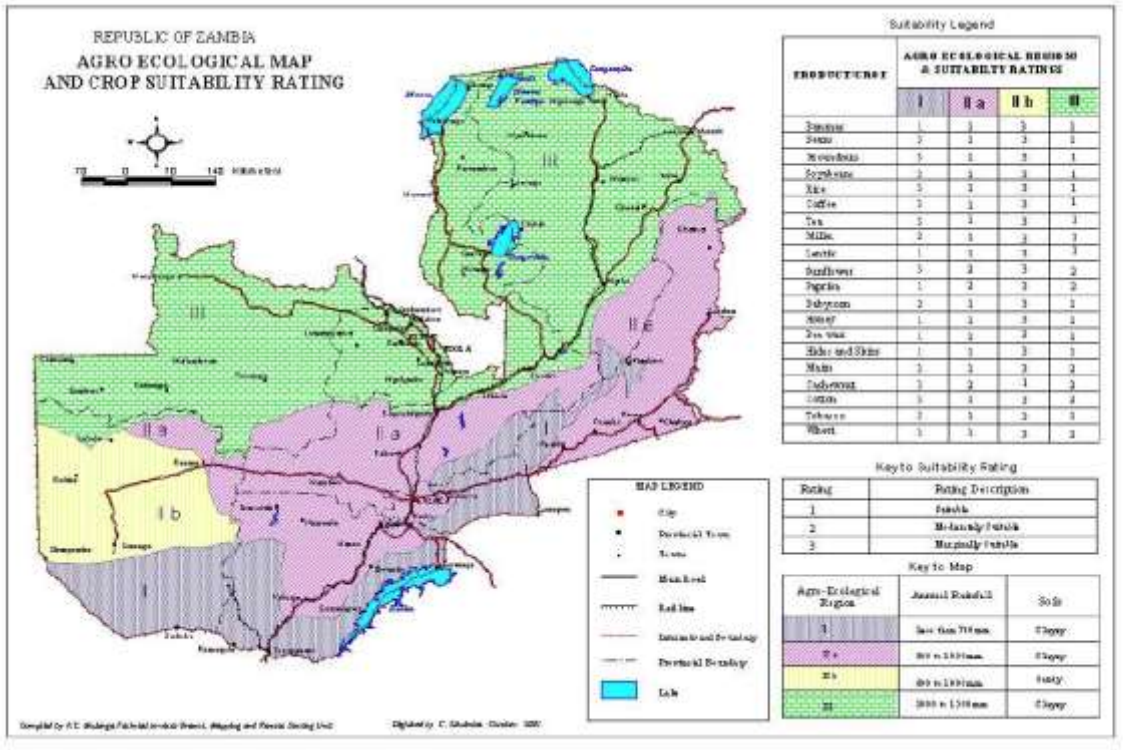
1. Cassava production zones



1. Maize production zones [10]

[10] Commercial Dynamics in Zambia's Cassava Value Chain, Food Security Research Project, Lusaka, Zambia – August 2008

Crops in Zambia and impact of climate



Agro-Ecological Map and Crop Suitability Rating for Zambia (based on soil types)[11]

	Agro Ecological Regions & Suitability Ratings			
Product/Crop	I	IIa	IIb	III
Bananas	1	1	3	1
Beans	3	1	3	1
Groundnuts	3	1	3	1
Soyabeans	3	1	3	1
Rice	3	1	3	1
Coffee	3	1	3	1
Tea	3	1	3	1
Millet	2	1	3	1
Lentils	1	1	3	1
Sunflower	3	2	3	2
Paprika	1	2	3	2
Babycorn	2	1	3	1
Honey	1	1	3	1
Bees wax	1	1	3	1
Hides and Skins	1	1	3	1
Maize	3	1	3	2
Cashewnut	3	2	1	2
Cotton	3	1	3	2
Tobacco	3	1	3	1
Wheat	3	1	3	2

Rating	Rating Description
1	Suitable
2	Moderately Suitable
3	Marginally Suitable

[12]

[11] Formulation of the National Adaptation Programme of Action on Climate Change, Zambia, September 2007

1.1. Climate change impacts across key sectors

Agriculture

The Strategic Program for Climate Resilience Zambia (PPCR 8 SPCR Zambia)[13], describes the key climate risks to Zambia in particular vulnerability to drought and floods and a general increase in climate variability.

The agricultural sector, and in particular smallholder farmers, are especially vulnerable to climate variability and climate change impacts. This is due to their heavy dependence on rain-fed systems and the country's limited irrigation capacity (especially at smallholder level). Smallholder vulnerability is also exacerbated by reliance on maize cultivation as the principle food security crop. Analysis indicates that climate variability is currently reducing maize production by at least 30 kg per capita below what is estimated under a normal rainfall scenario[14]. This poses a particular threat to food security.

There is an urgent need to transform smallholder agricultural systems in the face of these challenges. Such transformation can be supported by the adoption of 'climate-smart' agricultural practices, many of which also deliver mitigation benefits through sequestration of carbon in trees and soils. However for this transformation to be realised, smallholders need support in the form of: technical assistance in adoption of climate resilient farming practices; access to high quality farm inputs and technologies (i.e. improved seed varieties, irrigation systems, fertilisers); access to credit; and access to markets. This cannot be delivered at the scale required by public institutions alone, and requires innovation and resources from the private sector in equal measure.

Energy
Zambia is heavily reliant on hydropower to meet existing and future electricity generation requirements. This poses specific challenges: Firstly, increased economic development is driving increased demand for water for other uses (i.e. agriculture, industry, and mining). Secondly, increased demand for electricity requires increased water supply. Climate change impacts will exacerbate these stresses further. Erratic rainfall patterns and greater evaporation will further impact water supply available for energy production.

Interventions to build the climate resilience of the electricity provision in Zambia will have to be multi-sectoral. Natural resource management and sustainable agriculture will need to be implemented across watershed areas to increase infiltration and reduce sediment run off into rivers. This will need to be supported by energy diversification strategies at both centralised and decentralised scale. Solar, biogas, and wind all have potential for implementation in urban and peri-urban areas (where charcoal remains the primary source of household energy), and in rural areas (where fire wood remains the primary source of energy). Once again innovative financing structures will be required if implementation is to be successfully rolled out at the scale required.

Water
Zambia is endowed with abundant surface water resources. However communities living in the arid southern agro-ecological zone of the country, experience severe water shortages during the summer months[15]. In addition, the mismanagement of groundwater resources in heavily populated urban areas, has also put pressure on this scarce resource. Increased climate variability and incidence of extreme weather events will increase the vulnerability of populations in these areas[16]. Periods of drought will have especially negative impacts, resulting in inadequate recharging of groundwater, drying of boreholes and other water courses, and lowering water tables.

Interventions will be required that can increase access to water sources in vulnerable areas, whilst improving efficiency of use. While solar or manual power water pump technologies, coupled with water optimisation systems (i.e. drip irrigation) hold significant promise, innovative financing mechanisms will be needed if these are to benefit the most vulnerable households.

Natural capital

[12] http://mail.sardc.net/books/NAPAZambia/Figures/Fig1-1.jpg
[13] Appendix 7, A.7 Zambia Development and Climate Risks
[14] Ibid
[15] http://unfccc.int/resource/docs/napa/zmb01.pdf
[16] Ibid

Natural capital, including miombo woodland ecosystems located in national parks, are particularly vulnerable to both the physical and socio-economic impacts resulting from climate change. The natural regeneration capacity of miombo is predicted to reduce under higher temperature scenarios . Coupled with this, evidence suggests that communities bordering natural forest areas are likely to increase unsustainable resource extraction (i.e. charcoal production, game poaching) as a short term coping mechanism against negative income shocks. These pressures are likely to see increased degradation of such natural resources as a consequence of climate change.

Successful interventions will require both the provision of climate resilient livelihood alternatives for forest dependent communities, and coordinated implementation of climate resilient management activities in and around Zambia's national parks and game management areas.

1.2. Climate change impacts: Barotse and Kafue

The rural population in the Barotse and Kafue sub-basins comprise almost a third of Zambia's population and are amongst the poorest and most vulnerable communities in Zambia. This is not only because of the prevalent climatic conditions and recurrent floods and droughts but also because of their relative socio-economic isolation and reliance on rain-fed agriculture as the principle form of livelihood. For the Kafue and Barotse sub-basins improving food, energy and water security is fundamental for building climate resilience.

These regions are vulnerable to destructive farming practices which deplete the soils and result in low yields (particularly maize). The net effect of diminishing returns from such farming practices results in farmers moving areas, depleting farming land as they move. Rural/agricultural communities often supplement their income by running charcoal burning businesses which are resulting in a rapid rate of deforestation, further increasing the vulnerability of communities to climate variability and change.

The Barotse sub-basin populations include groups of the most vulnerable communities in Zambia. It encompasses sections of Region 1 and Region 11b. It comprises the Barotse Floodplain (Zambia's second largest wetland), and the Lozi tribe who depend on the floodplain for irrigation, fisheries, wildlife and cultural events. A key agricultural focus is aqua-culture, and livestock remains an important indicator of wealth to the Lozi.

A series of canals from the floodplains are used to irrigate land – however these traditional ways of managing natural resources are being compromised by "intense logging and fishing (sic), increasing concentration of cattle ownership, economic monetization, and conflicts between central government authority and traditional leadership"[17] .Climate change adds to this pressure by exposing the farmers to increased climate variability including - additional unexpected floods and drought. The canals are being damaged by silt and becoming un-navigable.

The Barotse sub-basin is characterised by low rainfall (both Regions I and IIb) – however, a review of the crop suitability chart from Zambia National Adaptation Plan (NAPA), shows that Region I has more opportunity for introducing a climate resilient agricultural intervention than Region IIb. Additional agricultural activities that can be delivered in Region I include, bananas, lentils, paprika, honey, bees wax, hides and skins and cassava.

The sandy soil of the Kalahari Region agro-ecological zone means that agricultural opportunities are more limited than other regions in Zambia. However, it is still possible to grow rice and maize in the floodplains. Additionally there are opportunities to increase cashew nut and mango production further.

The Kafue sub-basin consists mainly of Regions IIb, III and whilst these are more productive areas agriculturally, they are still subject to climate variability challenges including floods, drought, disease, flood induced landslides and pollution. These challenges are exacerbated by the scale of deforestation in the area, about 50% of the population inhabit approx 20% of the land – and is the location of much of the country's' mining, industrial and agricultural activity.[18]

The land and soil type allows agricultural opportunity for a variety of crops – as detailed in the crop suitability table above, providing opportunity for diversification from current staple crops of maize and cassava.

[17] Zambia PPCR Strategic Programme
[18] Zambia PPCR Strategic Program - Endorsed

2. Our Approach

2.1. Background

The objective of this report is to provide IFC with priority business interventions that meet the PPCR objectives and which could be viable for IFC investment. In our work we identified and assessed a range of interventions against four critical requirements:

- potential to deliver significant resilience benefits;
- potential for transformative impact,
- feasibility, and
- Interest of the private sector.

Those interventions which demonstrated adherence to these critical requirements were then explored in further detail and are described in section 4.

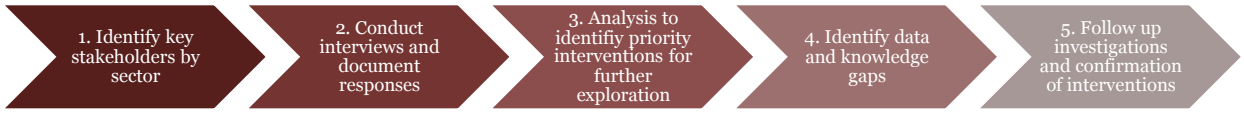
In developing this report we completed and documented the following activities:

1. An inventory of stakeholder organisations with focus in any one of the following sectors – agri-business, water, energy and natural resources with an interest in or potential interest in the Kafue and Barotse sub-basins (Appendix A3);
2. Identified and described private sector interventions that could improve food, water and energy supplies in the face of climate change;
3. Determined an indicative feasibility and willingness of potential private companies to invest in the identified interventions;
4. Descriptions of the specified interventions with their expected adaptation benefits, including financial and economic assessment where appropriate;
5. Described the adaptation rational of the interventions, in line with the World Bank definition; and
6. Provided an indicative list of potential partners – who have expressed an interest in the interventions discussed.

2.2. Our Approach

In order to establish the most suitable business interventions for IFC support, we undertook a five step approach as set out in Figure 2.

Figure 2: The five steps in our approach



Details on each of these steps and progress made, is provided below

2.2.1. Identification of key stakeholders by sector

A set of stakeholders across the five priority sectors of finance, agriculture, water, energy and natural capital, was identified through consultation with the IFC and through PwC's network in Zambia.

2.2.2. Conduct interview and document responses

Telephone and face-to-face interviews were scheduled and carried out with each of the stakeholders identified. These interviews were used to:

- Identify and refine a set of potential interventions to be taken forward for analysis;
- Explore the potential roles and existing capacities of stakeholders in delivery of potential interventions;
- Assess the indicative interest and willingness to invest in the potential interventions amongst private sector stakeholders;
- Collate expert opinions as a basis for evaluating the indicative feasibility of the potential interventions; and
- Collate expert opinions as a basis for understanding the effectiveness in addressing climate vulnerability for each of the potential interventions.

An inventory of stakeholders who are operating in the Kafue and Barotse sub-basins is set out below in Table 1. Consultations were held with a majority of these stakeholders to discuss the above and follow on conversations scheduled where required. Over 70 stakeholder organisations or individuals were consulted during our field work.

Table 1: Stakeholders identified for consultation by sector

Sector	Finance	Agriculture	Water	Energy	Natural Capital
Inventory of stakeholders who operate in the Kafue and Barotse sub-basins	• Stanbi • ZSIC • Natsave • Madison • Mayfair Insurance • BancABC • Development Bank of Zambia • Vision Fund • ZANACO • Barclays • AgDevCo • iDE	• Pioneer seed • Zambeef • Musika • NutriAid Trust/Agribusiness Forum • Sylva Food • Cropserve • Dunavant Cotton • John Deere • ZNFU • SARO • AFGRI • Zamseed • Omnia • CFU • COMACO /It's Wild • Zambia Sugar • Spar • Technoserve • GKI • Rolf Shenton	• Devolution Trust Fund • WASAZA • Department of Water Affairs • Potential members of the Water Users Association	• ZESCO • Rainlands Timber • Africa Carbon Credit Exchange (ACCE) • CEC • 3 Rocks • GKI • Save 80 • Rural Electrification Authority • Tata Zambia	• Lumwana • Mukambi Safari Lodge • The Nature Conservancy • Nedbank (Barotse) • Conservation Science Africa (Kafue) • Richard Jeffery • Biocarbon Partners • Lumwana mines • Protea Hotels • Intercontinental • Southern Sun Hotels • Taj Pamodzi • Zambia Tourism Board • ZAWA • Prof. Hoffman • Game farmers (Judy Carr, Peter Fisher, Don Stacey), • Barry Bell-

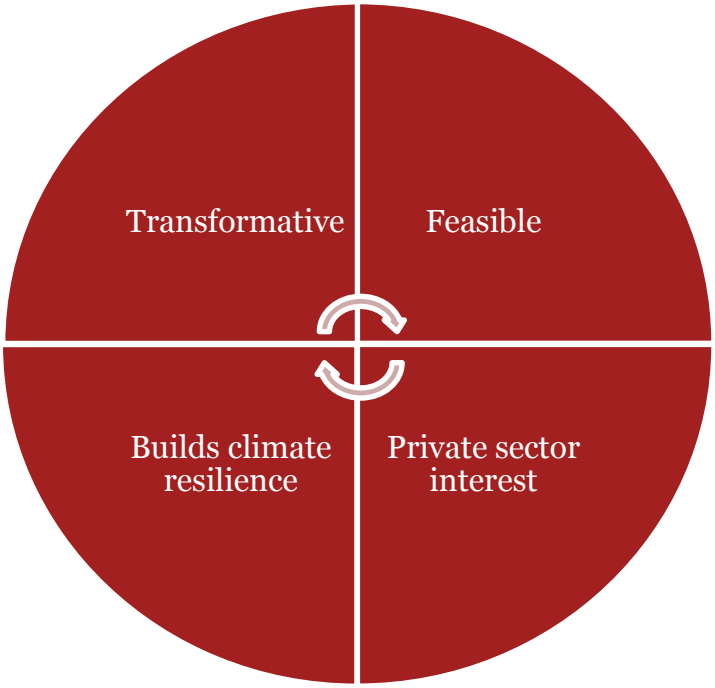
Sector	Finance	Agriculture	Water	Energy	Natural Capital
					Cross

2.2.3. Critical requirements for priority interventions

In order to shortlist a set of priority interventions for further exploration, each of the potential interventions was analysed against four critical requirements. These were:

1. Potential to deliver significant climate resilience benefits
2. Potential for transformative impact
3. Feasibility
4. Willing private sector investor identified

Figure 3: The four critical requirements for priority interventions



The criteria used to assess each of the above critical requirements are outlined in Table 2.

Table 2: Criteria used to assess each of the four critical requirements

Climate resilience	Transformative impact	Indicative feasibility	Willingness of private sector to invest
• The intervention will enhance soil retention and/or vegetative cover • The intervention will enhance water retention in soils and/or improve water effectiveness of water management systems • The intervention will improve fire risk management • The intervention will enhance agricultural productivity under climate change conditions • The intervention will provide alternative livelihood opportunities by generating income from carbon markets	• The intervention is scalable • The intervention involves innovative use of technology • The intervention has the potential to increase access to finance for vulnerable groups • The intervention has the potential to provide access to markets for vulnerable groups	• The intervention financially feasible • There is a commercial opportunity • There is an existing or potential market for produce • All potential intervention partners have the necessary technical and management capacity required **or** IFC Advisory teams are able to provide appropriate support • There is an enabling legislative / regulatory environment to support the intervention	• Private sector stakeholders have expressed interest in using IFC funding to underpin implementation of the intervention

2.2.4. Intervention Scoring

Climate Resilience and Transformative Impact

We assessed each intervention against each criterion and awarded it a score based on the following:

Scoring key	
High Impact	3
Medium Impact	2
Low Impact	1
N/a	0

For example, when evaluating each intervention against fire risk management, promotion of nutritious crops would score n/a (0) while sustainable game farming would score medium (2).

The score obtained for each intervention against each criteria was totalled. This total score was then used to assist in prioritising the business interventions that were considered for further detailing investigation.

Indicative feasibility

Based on discussions with relevant stakeholders, we assessed each intervention against the above criteria to establish the interventions indicative feasibility, as defined in the Economic Matrix table in Appendix A1 as either Low, Medium or High.

Willingness of private sector to invest

Based on discussions with private sector players, we have explored their indicative interest in investing in a particular business intervention.

The results from our analysis were used to identify priority interventions as follows:

- Given the importance of private investment, if no private sector partner was identified, we decided not to take the intervention forward for further investigation;
- Where discussions indicated the feasibility of the intervention to be low, we decided not to take the intervention forward for further investigation. In cases where insufficient discussions were held, the intervention was not ruled out until additional steps to collate outstanding information were undertaken.
- For the remaining interventions, we used the total scores from the Climate Resilience and Transformative Impact to prioritise which interventions should be investigated further.

The following Table summarises the priority interventions that were investigated.

Intervention	Sector
1. Smallholder soya production	**Finance**
2. Smallholder soya production	**Agriculture**
3. Indigenous crop production	**Agriculture**
4. Game Management and Tourism Investment 4a. Sustainable game management and game farming 4b. Tourism Investment	**Natural Capital**
5. Redd+ Considerations	**Natural Capital**
6. Promotion of renewable biomass fuels for cooking	**Energy**
7. Smallholder livestock production and rural abattoirs	**Agriculture**
8. Establishment of private sector water user association and water security fund	**Water, Agriculture, Energy and Natural Capital**
9. Green villages concept	**Energy and Natural Capital**
10. Renewable charcoal production (bamboo/miombo)	**Energy and Natural Capital**
11. Programmatic Integrated Intervention	

In addition to these individual interventions – we believe there is a good opportunity to link a number of the most feasible projects into a large scale programme – in which the combination of interventions are implemented in a manner to support the successful implementation of a REDD+ project within a National Park – for example Kafue National Park.

Dashboards providing a description and rating of the interventions are provided in full in Appendix 1. Through a process of analysis, further investigation and discussion with the IFC following the preparation of the interim report it was agreed that the focus of the final report would be refined into four key interventions:

1. Access to Finance (A2F)
2. Smallholder Soya/Climate Smart Agriculture
3. Game Management and Tourism Investment
4. REDD+ Considerations

3. Detailed Private Sector Investments

In this section we review the following four short-listed interventions in further detail, and articulate the type of investment support being requested from the IFC. We also describe a fifth, broader, programmatic integrated intervention.

3.1. Access to Finance (A2F)

The agriculture sector contributes approximately 20%[19] to the Zambian GDP and employs approximately 60% of the national population. Of this, over 85% [20]are small or emergent farmers who have limited access to finance. Company A estimates the smallholder farmer base to be 2.3 million.

This intervention is focused on the smallholder farmer (defined below), which for the purposes of this study is considered to be less than 2 hectares. In Zambia it is estimated that 1.5 million households (equivalent to 9 million people) are smallholder households dependent on agriculture. Smallholder farmers in Zambia are most at risk from climate change and climate variability. A combination of traditional farming practices, involving clearing land farming until depleted before moving to open new land – is contributing to low yields, increasing rates of deforestation and food insecurity. It has been difficult for farmers to respond to these challenges as they have had difficulty accessing finance to be able respond to the climate change challenges (for example to buy irrigation). The difficulties accessing finance are in the main due to:

- Low yields due to inadequate agronomic skills
- Lack of adequate financial management skills
- Poor record keeping

This intervention links Access to Finance for smallholder farmers, with climate smart agricultural practices, such as climate smart agriculture techniques, multi-cropping to replenish soil, access to irrigation and other technologies that support farmers to adapt to climate change.

Small and emergent farmers are typically excluded from access to Finance, as they are perceived as high risk, inexperienced borrowers who require high levels of support, which is expensive to run. However a recent study "Catalyzing Smallholder Agricultural Finance"[21] highlights that this group of farmers, in particular the smallholder farmer "represent an increasingly important segment of the global food market"[22]. This increased interest in this segment of farmers is demonstrated in company's successful programme:

- 2008 - 1 billion Zambian Kwacha loan portfolio set up for smallholder farms
- 2011 - US$4 million loan portfolio servicing 4,723 smallholder farmers
- 2012 - US$13 million loan portfolio planned, to service 18,875 farmers

A repayment rate of **100%** has been witnessed and the smallholder farmer segment group is performing better than the other more traditional agricultural market segments.

Company A has highlighted that the smallholder farmer segment is of interest to it and as part of its strategy it informed PwC that it will be focusing on this group of farmers as it is of increasing commercial interest for the

[19] Zambia National Farmers Union
[20] Discussions with company AC
[21] Catalyzing Smallholder Agricultural Finance (Dalberg)
[22] Catalyzing Smallholder Agricultural Finance (Dalberg), p2

bank. It is part of company's strategy, driven by company J's philosophy for business and is based on principles of financial inclusion, rural reach and financial literacy with the aim to take low cost products to the masses.

Drivers for the increased interest in this segment of farmers include:

- Growing **urban middle classes** who are driving up demand for **horticultural products**, both from retail supermarkets and open markets (which sell approximately 80% of market share)[23]

- **Commercial demand** for agricultural produce, for example, in 2011 200,000 tonnes of soy produce were produced in Zambia. Demand from company H alone was for 100,000 and they were only able to procure 90,000 tonnes within Zambia. Company H has indicated that it would be interested in securing soy produce within Zambia from smallholder farmers.

- A significant cross border **export opportunity** into South Africa, Zimbabwe, Malawi, Tanzania and the Democratic Republic of Congo (DRC) – a significant proportion of current exports are informal transactions, which are not accounted for, which suggests the market opportunity may be underestimated.

- A **commercial opportunity** for **lenders**, to be able to tap into the smallholder farmer market. There is increased interest in the market for agricultural financing, and the success of company's Programme A fund, offered to members of the Zambian National Farmers Union (ZNFU) who qualify as emergent farmers is compelling. In the first year the programme aimed to fund farmers in two districts – with a loan portfolio value of 600 million kwacha (US$120,000). Three years later the loan portfolio is at US$18 billion (approx US$3,430,000) and services 10,000 farmers.

    - For the season 2012/13 company A received 14,000 applications for 10,000 loans. If we consider that the membership base of ZNFU is 300,000 the scope scaling up an agricultural financing proposition is evident particularly if the larger smaller holder farmer group was targeted.

- **Smallholder farmers** being increasingly treated as **business partners**, rather than beneficiaries of charitable support. In their successful programme, targeting smallholder farmers, company AC currently works with approximately 16,000 smallholder farming families – assisting them to move from subsistence to higher value farming. Key to their approach is an access to finance component described as follows: "*company AC, in partnership with the Zambian MFI CETZAM, has pioneered the development of credit products and services specifically designed for small-scale farmer business. Contrary to most expectations the results of this partnership have been impressive, with repayment rates of over 97% on a loan portfolio of US$1.4 million and over 2,800 client farmers. This cooperation model has demonstrated that commercial agricultural credit provision to small scale farmers is possible. There are enormous opportunities further to scale credit products across the country with further inputs of capital and technical support*"[24]

- Opportunity for **suppliers, aggregators** and **off-takers** to increase volumes of commercial activity – if able to link in effectively with the smallholder farmers. The technical assistance required to link farmers to the value chain is typically dependent on grant or soft loans. However, by leveraging company AC's award winning Farmer Business Advisory (FBA) methodology – these links can be commercialized. In effect using market incentives to drive up demand for inputs to the farmer, aggregation of crop services and linking the small holder farmers into the value chain via the off-takers.

In the context of this intervention, we consider how banks could leverage the success of loan fund from company A's programme and the company AC FBA methodology – to target smallholder farmers as potential customers for agricultural finance products.

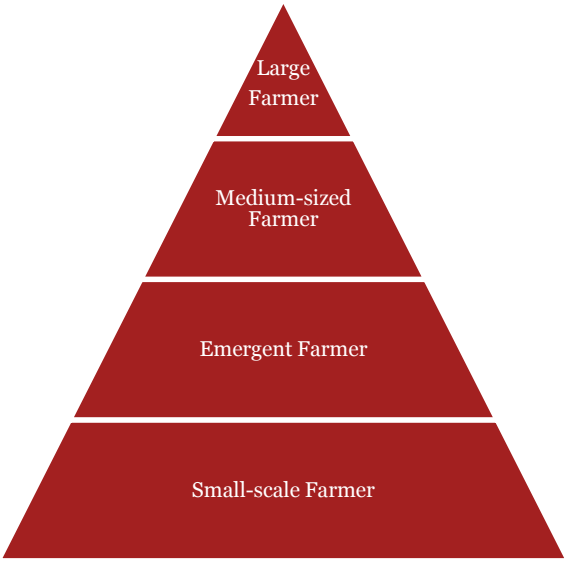
[23] Re-governing Markets – small scale producers in modern agrifood markets, p2
[24] House of Commons International Development Committee, DFID's programme in Zambia, Fifth Report of Session 2012 -13 – "Written evidence submitted by company AC"

This intervention assumes, that:

- This product is a commercial bank product
- This is a loan only accessible by groups/cooperatives of farmers (who have had their risk reviewed). Individual loans are assumed to be a Micro Finance product.
- There is a minimum transaction cost to each loan (for example $10,000 to a group of farmers)
- The loan product developed is tailored specifically for agriculture with delayed repayments built into the loan structure.
- Loans are only issued to farmers in collectives or unions, with joint and several liability
- Farmers decide what they want, and have the option to select from various input suppliers (with the Farmer Business Advisor support)
- The farmer is treated as a customer
- The FBA gets paid 10% – 15% of the total commission on processing successful loan applications and the balance when the loans are fully repaid.

3.1.1. Current challenges Faced

Access to agriculture related finance in Zambia is predominantly a reserve for medium to large scale operators who in most cases have the relevant expertise, market linkages and asset base to access financing. However, emergent and small scale farmers struggle to access finance for their operations thereby leaving them susceptible to various factors, including the negative impact of climate change. Given the limited financial resources available to this vulnerable sector, mitigation of climate change impacts is not possible.



Description	Large Farmer	Medium-sized farmer	Emergent Farmer	Small-scale Farmer
Average land size	>300ha Always on title	20-300ha Always on title	2-20ha Usually on title	<2ha Almost always no title
Labour	Mainly skilled labour	Combination of family and external labour	Mostly family members	Mostly family members
Technology used	Mostly mechanised	Partly mechanised	Minimal mechanisation	Usually no mechanisation
Resources available	Formal bank loans and access to external capital	Limited access to bank loans	Limited resources including skills, capital and labour	Limited resources including skills, capital and labour
Capacity and value chain	Good market access with own storage/ logistics and will positioned within the value chain	Reasonable access to markets but limited market information	Access to market and information dependant on strength of any farmer groups	Limited capacity to store, market or process and are often vulnerable in the supply chain

As outlined above, each group in the agriculture sector possesses varying characteristics that contribute to their ability or inability to access finance from financial institutions[25]. Access to appropriate finance by the emergent and small-scale farmers is mainly hindered by the following factors:

- Small-scale farmers in rural communities do not hold title to their land or own any significant movable assets and as such, lack the ability to pledge any collateral to access finance
- Transactions costs for smaller loans are generally higher than those compared to facilities to medium to large scale lending
- Financial management capabilities of small-scale and emergent farmers in rural areas is limited and understanding the terms of technical loan transaction often seems to be a challenge

[25] IFC and Agri-finance
IFC: Pilot Programme for Climate Resilience (PPCR) - Private Sector Support to Climate Resilience in Zambia

- Yields achieved by this segment are generally lower than medium and larger scale farmers, thus reducing the ability to honour financial commitments
- In most cases, rural communities have limited access to markets for their produce and are dependent on middle men/traders who often pay below market prices to these communities
- Given that rural communities are usually located great distances from financial institutions, accessibility to loan officers is limited and can often be costly.

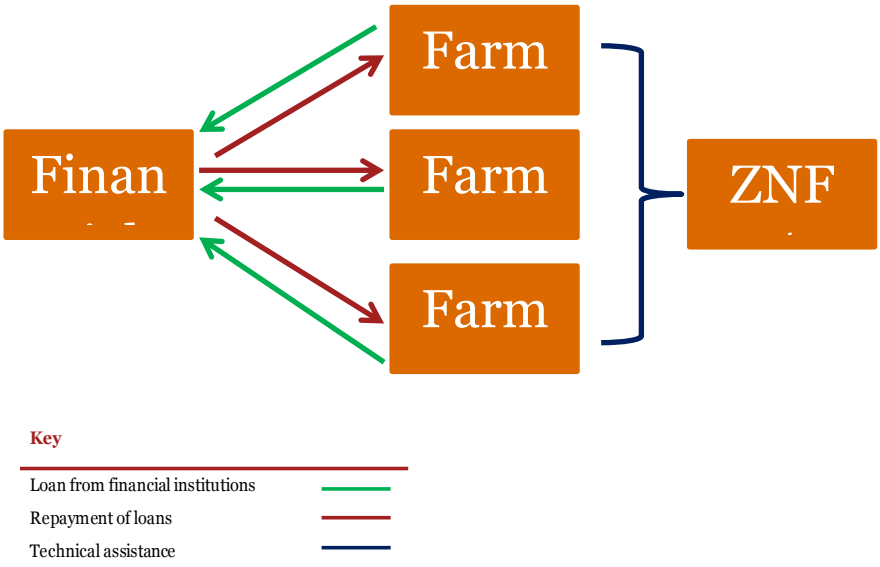
3.1.2. Impact of Challenges

Accessing appropriate finance and technical assistance by small and emergent farmers could play a significant role in assisting rural communities acquire appropriate technologies to mitigate adverse climate change impacts and reduce their vulnerability to changing environmental conditions. In addition, accessing finance could allow small and emergent farmers to engage in year round cropping and not be rain reliant.

Based on discussions with various financial institutions, their reluctance to lend to this segment of the market has resulted from the notion that it generally has a much higher risk profile and would be expensive to service given limitations in branch network and access. In this regard, one of the ways to overcome these challenges and reduce the risk of lending to small and emergent farmers would be to incorporate a middle man located within these communities and who has the knowledge and capability to create linkages between the farmers and the private sector markets, input suppliers while providing the relevant technical assistance.

3.1.3. Intervention Description

Based on discussions with various stakeholders, the current lending process to small and emergent farms is generally very simplistic and has limited stakeholders to monitor performance and provide technical assistance.



The proposed intervention involves the creation of linkages between small and emergent farmers to a Farm Business Advisor ("FBA") who would be a lead farmer in a rural community. The FBA model was first initiated by company AC and has been successfully piloted in Cambodia and Zambia with approximately 9,000 and 16,000 farmers benefiting in the two countries as at October 2010 and September 2012 respectively[26]. The FBA model applied by company AC currently focuses on the provision of extension services and linkages with input

[26] Discussions with company AC and ZNFU

suppliers and pilots have indicated that this model has enhanced productivity resulting from the use of efficient irrigation methods for all year cropping.

Given the success of this model, our proposed intervention aims to expand the role of the FBA to include the provision of linkages with financial institutions and potential off takers, thereby increasing the revenue generating ability and motivation of FBA's. This process would allow for the screening of potential borrowers on behalf of financial institutions prior to lending, as well as continued monitoring until the loan has been fully repaid.

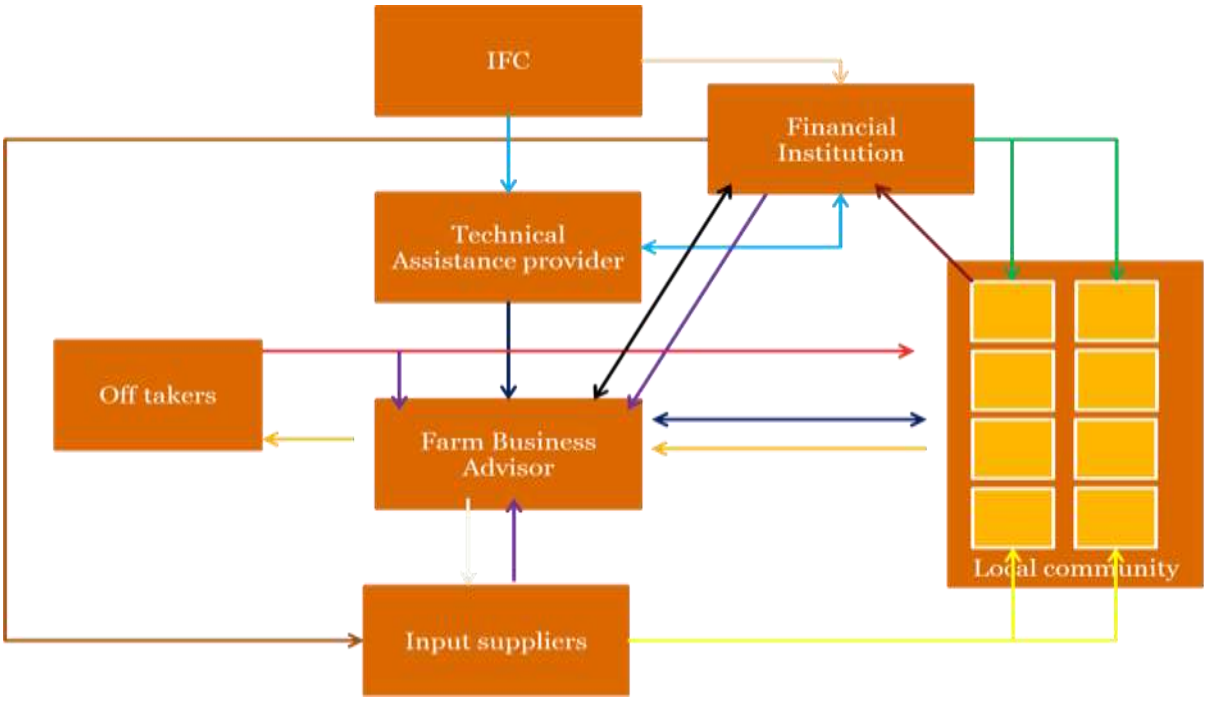
In addition to creating the above linkages, our proposed intervention would seek to incorporate the shift from existing traditional agricultural systems to new farming methods that improve productivity and reduce variability in crop yields arising from changes in temperature and increasingly erratic weather patterns. This change in farming systems would be facilitated by ensuring the adoption of Climate Smart Agricultural ("CSA") practices[27] are a pre-requisite to any loan application.

CSA practices would involve a transformation in natural resource management (including land, water and soil nutrients) and could lead to higher productivity, climate resilient crops and substantial mitigation benefits through enhancing carbon sequestration in trees and soils, and reducing emissions per unit of output.

In order for the CSA practices to be effectively transferred to FBAs and subsequently to local farmers, organisations such as company AC would play a key role in the intervention. Financial institutions would need to partner with company AC and/or other similar organisations to provide identified FBA's with the necessary training and continued support.

27 PwC and Rockefeller Foundation, September 2011, Climate-smart agricultural practices: Nine factsheets, Report 1: Climate-Smart Agriculture in Sub-Saharan Africa Project

The schematic below illustrates transactions within the proposed Access to Finance intervention:



3.1.4. Climate Change Rationale

The rationale and benefits for providing access to finance to small and emergent farmers from a climate change adaptation perspective include:

- Allowing farmers to invest in efficient irrigation technologies such as solar or treadle pumps and drip irrigation which would allow farmers to produce year round crops and not be reliant on rain;
- Allowing farmers to invest in green house technologies to mitigate the impact of climate change on their crop yields;
- Allowing farmers to invest in alternative non-maize agriculture such as fish farming, livestock and poultry production to diversify and enhance food security;
- Allowing famers to invest in technologies to maintain the value of their produce given the logistical challenges in delivering these to markets e.g. solar driers can be used to extending shelf life;
- If the financial institutions could use the implementation of CSA practices as a pre-requisite for all loan applications, significant climate change adaptation and mitigation benefits would be achieved. In

addition, financial institutions could stipulate as part its terms that if the borrower is someone who is engaged in active deforestation practices (e.g. charcoal production); the loan application would not be approved.

As set out above, CSA methods lead to climate resilience crops and higher productivity. We set out an extract from Report 1, Climate-smart agricultural practices: Nine factsheets: Climate-Smart Agriculture in Sub-Saharan Africa Project at **Appendix A4** which provides a description of the main activities and their potential benefits. The climate change adaptation benefits of CSA include:

- The ability to diversify and invest in year round crops thereby reducing smallholders' dependence on single rain fed commodities (maize) resulting in increased resilience.
- Improved resilience to drought by using improved crop varieties and seed.
- Increases in rainwater infiltration and reduced soil erosion through the use of sustainable land management practices
- Improved soil fertility through the use of organic matter
- Improved synthetic fertilizer application methods that result in reduction in quantities required
- Increased pest resilience through provision of habitat for predators which prevent pest out breaks
- Effective agro forestry that prevents land degradation, improves microclimate and increase ecosystem stability
- Improved grazing land and pastures could enhancing livestock productively and resilience to drought to enhance social security for vulnerable communities
- Diversified and zero waste integrated food-energy systems that would provide sustainable energy sources and prevent deforestation.

3.1.5. PPCR Results Framework

The intervention will improve the quality of life for people living in some of the most vulnerable situations globally in terms of the impact of climate change. The intervention has the potential to significantly boost household food security for the 404,000 farming households[28] in the Kafue and Barotse sub-basins, and enhance socio-economic and biophysical resilience to climate change impacts.

The use of CSA practices and linking these with multi crop weather based insurance products, has the potential to reduce economic losses by smallholder farmers in the face of extreme weather events.

The intervention presents an opportunity to leverage new sources of finance, technical resources and markets from the Private sector in terms of: smallholder lending products from financial institutions, technical resources from both NGO's and community agro-dealers, potential private and public sector investments in PES certificates associated through CSA mitigation project development and private sector off takers.

As the majority of smallholder farmers in Zambia are women, the intervention also has the potential to deliver significant gender equality benefits.

3.1.6. Investment description

There are three key ways that IFC can provide support under this intervention.

1. To provide **a concessional credit line** to banks (companies A, B and C) for which agricultural financing can be provided to small and emergent farmers, for activities that deliver climate change adaptation benefits.

2. To support via **risk sharing** where banks have sufficient capital and do not want to have a concessional credit line extended to them, but instead are more interested in **risk sharing** on the loans issued to smallholder farmers.

3. To provide support building **agricultural loan officer capacity**, by paying for payroll costs for these additional resources as the smallholder farmer finance services were introduced and/or scaled up.

[28] Zambia: Strategic Programme for Climate Resilience , June 2011

Company A had this support in setting up their Programme A and were able to take on these full costs for the additional staff within two seasons, financed solely from Programme A.

Company A has indicated that it would be specifically interested in exploring a risk sharing option. Currently it manage the risk of smallholder farmers borrowing from it by demanding half of the loan as cash collateral upfront (for which the farmers get paid interest). This has worked well, and the repayment rate on smallholder farmer loans is currently standing 100%. They will service 18,875 farmers in 2012/13 and have aspirations to grow this number significantly – so that they can target a significant proportion of the estimated 2.3[29] million small holder farmers in Zambia.

The banks could also consider managing the interest rate of the loan to enhance the loan product, for example increasing the interest rate to incorporate the following:

- a weather based insurance product (costed at 8% of the total loan) as a mandatory component of the loan. It is assumed that all weather stations in the locality, required to deliver a robust insurance service delivery are financed from the Access to Finance intervention.
- an element of the funding to be allocated to the running of the extension services, via the FBA's.

However, this approach is subject to the banks' appetite for taking such an approach.

Having a comprehensive and well managed extension service is one of the significant upfront costs of this intervention. It is proposed to be delivered using Famer Business Advisor (FBA) methodology. Company AC or other similar organisations for the provision of competent field staff to train to FBA's on CSA practices. In addition, financial institutions would need to invest internal resource time in training and monitoring FBA's on the loan application and screening process.

Based on our interviews with company AC, the number of farmers per FBA and the number of FBA's per field staff would increase year on year based on a learning curve effect and also given that FBA's would over a period of time become semi autonomous with regards to CSA practices.

Given the cost implications of engaging with organisations such as company AC to provide the initial training and monitoring, IFC might provide concessional lines of credit to financial institutions as well as consider funding technical assistance providers through grant funding.

The proposed intervention is, in the long term, a sustainable process of empowering lead farmers in local communities and using them as catalysts to disseminate information on CSA practices and monitoring financial performance of farmers.

Some of the benefits that the proposed FBA model could achieve include:

- Financial institutions would have a single point of contact with a given community and would be able to use the FBA as an agent to market loans and monitor borrowers' performance thereby reducing the risk of default.
- Small and emergent farmers would be able to call on a local community member for technical assistance on CSA practices as well as advice regarding application of new technologies.
- FBA's and small and emergent farmers could increase their annual income resulting from increased yields.
- FBA would be able to provide tailored technical advice to community members rather than the generic advice currently being provided by technical assistance providers to farmer groups.
- By linking FBA's to local suppliers, FBA would have an understanding of what inputs (organic and synthetic) could be sourced locally for the benefit of local farmers, thereby ensuring input suppliers hold specific stocks of inputs appropriate for the local community CSA practice.
- FBA's would be able to provide financial management advice to ensure borrowers use their financial resources effectively.
- By linking the need for CSA practices to loan applications, various climate change adaptation and mitigation benefits (as set out in **Appendix A4**) can be achieved.

[29] Company A estimates of smallholder farmer numbers in Zambia

3.1.7. Economic Analysis

We estimate that the proposed intervention could achieve an internal rate of return (IRR) of 14.8% and a payback period of 4 years. [IFC removed the cash flow table, which contains the cash flow used to calculate IRR and payback period.]

In order to estimate the above cash flows and compute the potential IRR and payback period, we have made the following assumptions:

Criteria	Details				
Average cash loan size	K3,000,000 (includes assets finance and working capital)				
Loan tenure	12 months				
No. of instalments	2 instalments – based on the assumption that farmers would use the financing to facilitate two crop cycles in a year (rain-fed and irrigated)				
Interest rate	16%				
Loan facilitation fees	0.5% of loan value				
Loan default rate	2% of the number of farmers				
Annual cost per field staff – Company AC model	**Year 1:** K333.3 million – based on an estimate of US $200,000 p.a for 3 field staff salaries, management and operational costs				
Commission to FBA's	2% of principle loan value on full repayment				
Insurance costs	8% of principle loan value which would be added to the cash loan value				
Incremental cash costs for financial institutions	30% of Company AC annual costs				
Exchange rate	K5,000/US $ - assumed a constant over the 5 years				
Inflation	Ignored				
Taxation	Ignored				
Efficiency rate for field staff	50% over the 5 year period as estimated below:				
	Yr1	**Yr2**	**Yr3**	**Yr4**	**Yr5**
Average number of technical assistance field staff – company AC or similar NGO's	3	5	8	12	15
Field staff to FBA ratio	1:10	1:12	1:13	1:14	1:15
Average number of FBA's	30	60	100	167	231
FBA to farmer ratio	1:100	1:100	1:100	1:120	1:30
Estimated number of farmers	3,000	6,000	10,000	20,000	30,000
Annual cost (US $) for technical assistance – assuming 50% efficiency rate over the 5 year period	$200,000	$333,333	$533,333	$800,000	$1,000,000
Average cost (US $) of providing technical assistance per farmer	$67	$56	$53	$40	$33
% of company AC costs to be borne by IFC as grant funding	Nil	Nil	Nil	Nil	Nil

3.1.8. Operating Requirements

Given the significant amount of time and effort FBA's would be required to invest in assisting local farmers, our proposed intervention assumes FBA's would be remunerated through commissions from financial institutions on successful loan repayments and commissions from agro dealers from which the farmers would acquire their equipment/inputs. Based on discussions with company AC, we understand local input suppliers are keen to work with FBA's and are willing to provide them with commissions on referred sales.

In addition, as the FBA's role would also include aggregating the produce from local communities and arranging off take agreements with private sector players, FBA's could make a commission on these supply contracts as an incentive to ensuring the highest prices are achieved. Further, given the FBA's local presence, the risk of side selling by farmers to traders at below market prices would be mitigated.

In order for the enhanced FBA model to be effective, the FBA's would need to at the least, fulfil the following criteria:

- must be part of a local community and be able to monitor performance of between 20 to 100 farmers

- have good communication skills and understand the local dynamics of the community

- must have a mobile phone for communication with suppliers, financial institutions, off takers and extension officers

- must have an operational bank account

- must be a member of an company AC farmers group, ZNFU or other similar organisations to enable them receive technical updates, extension services and CSA training

Company D is a mobile payments company in Zambia – who already successfully run a mobile payments system selling airtime and DSTV time has also indicated an interest in being able to facilitate payments to farmers via their mobile payment system. This could be another earning opportunity for the FBA, who could run the mobile terminal and make the physical payments.

Another private sector company that has expressed interest in this intervention is company E.

Company E is a privately owned company in South Africa, focused on the creation of sustainable and profitable agricultural enterprises that are optimized from 'farm to shelf'. Key operations include primary agriculture - livestock, grains, and oils and fruit; agri-science, including consulting services, water technology and renewable energy solutions; agricultural inputs to farmers.

In Zambia, company E is represented via company F (exclusive distributor for company G). This inputs focused business has expertise in the development of speciality products for the identified regions, and facilitate introduction of these products into the market at an affordable price. There is an opportunity to sell bulk into the region but this would need to be managed in a co-ordinated fashion. Company E would be interested exploring how this model of delivery could be integrated with the extension services provided via the Access to Finance initiative.

Company E also provide consulting Agri Science services - and these technical services are often sponsored or supported via their partner in the region Company S and are typically delivered at cost price, and could be considered to be semi commercial models. There may be opportunity to explore how this service could be integrated with proposed Access to Finance extension services.

Company E do not have a strategic plan to make any capital investment into Zambia in the next 18 months, however they would be interested in Zambia as an investment destination after this time period - and would be interested to explore with the IFC potential investment partnerships in that time period.

3.1.9. Market, financial and technical risks involved

Extension services provided by company AC are expensive and it has to be considered how this will be funded in the long term. One option is for IFC to fund this for two – three years with a transition plan to withdrawal company AC's support after this time, but responsibility for the FBA's needs to be agreed as part of the transition plan. It may be that financial institution may want to own the approach – but there are reputational risks of banks being institutionally linked to the individual FBA's. Alternatively Option 2 would be for the financial institution to pay for the FBA services as part of the loan product (and cost it as such). However the reputational risk of linking the institutions to the individual FBA's remains.

3.1.10. Financial gaps

These financial estimates have been developed based on discussions with company AC and commercial banks, and all assumptions would need to be validated if a final decision is made regarding the type of IFC support, technical assistance and the financial institution's internal costs to develop the loan product.

3.1.11. Challenges/ Critical Success Factors

Some of the critical success factors to ensure the access to finance intervention is effective include:

- Whilst banks such as companies A and B indicated interest in this intervention they were clear that the structure of the products would need to make commercial sense including:
    - Size and cost of transactions. Currently a FBA services groups of about 8, with total loans of about $5,000 per group. The smallest transaction company A would engage in would be $10,000 – and so it needs to be investigated to see if the FBA methodology can be scaled up to deal with large farmer groups, managing larger transactions.
    - Off-takers and access to agricultural value chains would need to be guaranteed.

- How would cash management processes be managed to prevent side selling, ensure suppliers got paid and repayments were made by farmers on a timely basis?

- There are bank structures, cooperatives (such as ZNFU) and extension services already in place and it should be explored how these can be best leveraged to support the success of this programme.

- Appropriate training to FBA's on the financial institution's loan application processes, effective screening procedures and financial management for onward transfer to smallholders.

- High quality technical assistance to support knowledge transfer from field staff to FBA's and FBA's to local community farmers. The involvement of company AC and other potential partner NGO's who have experience working with smallholder farmer groups is essential.

- Support from rural agro dealers to provide high quality seeds and other soft farm inputs.

- Formalised agreements between financial institutions and hard input providers (i.e. greenhouses, irrigation equipment) to provide, train farmers on installation of equipment, and provide reliable access to spare parts (i.e. irrigation piping) when needed.

- Sufficient private sector appetite to source produce from smallholders is required to ensure off-take agreements can be put in place.

- Formalised agreements between financial institutions and insurance providers who have the capabilities to provide weather based insurance products. This would allow financial institutions to reduce their risks and in the medium to long term, be able to reduce their interest rates.

3.2. Smallholder Soya/Climate Smart Agriculture

The majority of smallholder farmers in Zambia are reliant on traditional slash and burn agricultural practices in primarily in production of maize. With limited application of organic (or inorganic) fertilizer, such mono-cropping coupled with the annual residue burning regimes quickly deplete the nutritional quality of soils resulting in declining crop yields. As soil quality is depleted, the biophysical resilience of the system also diminishes. As soil organic carbon (SOC) is reduced in soils, water holding capacity reduces, and susceptibility to soil erosion increases. This in turn leads to increasing variability in crop yields in the face of extreme weather events such as drought and flood brought on by climate change.

In the face of these challenges, smallholder farmers traditionally adopt coping strategies. Firstly, as yields decline, new farm plots are opened up, often by clearing forest areas. Secondly, when faced with a lost harvest as a consequence of drought or flood, smallholders often turn to non-agricultural livelihoods as a short term coping mechanism, notably charcoal production. These strategies lead to an increase in deforestation activity in Zambia, and do not represent sustainable strategies for rural households to adopt in the context of population and climate change pressures. Furthermore, depletion of soils is a significant source of GHG emissions.

A solution to these challenges is the adoption of 'climate-smart' agricultural practices that can sustainably enhance the nutritional quality of soils, increasing yields, improving biophysical resilience, and sequestering carbon in soils. Adoption of these practices removes the need for households to open up new farm plots, reducing deforestation pressures. Several types of 'climate-smart' agricultural systems exist, and typically involve adoption of combinations of conservation agricultural practices (i.e. reducing tillage, increasing soil cover with mulch and green manures, and use of crop rotations and especially use of legumes), agro forestry (and especially use of nitrogen fixing trees and perennials such as *Faidherbia albida, Gliricidia*, and *Ferosia*), and water harvesting and management techniques.

The intervention proposed in this section of the report, involves promotion of 'climate-smart' agricultural practices in production of soya and maize. Soya is highly suited to production through a 'double-up legume' system, and due to its strong market potential in the region, can provide households with a valuable surplus cash crop, that in turn can underpin the A2F intervention described above in Section 3.1. When produced in rotations with perennial crops such as pigeon pea (which are also more resilient to harsh conditions as their roots are longer and more able to access the soils nutrients and water)., it can lead to significant and sustainable increases in maize yields. The increase in maize yield is significant because it is projected by the Intergovernmental Panel on Climate Change that "Southern Africa would be likely to experience notable reductions in maize production under possible increased ENSO conditions (Stige et al., 2006)[30] ensuring households surpass their food security requirements. By enhancing household food security, providing access to markets for cash crops, and enabling access to finance, can significantly improve the economic resilience of households in the face of climate change.

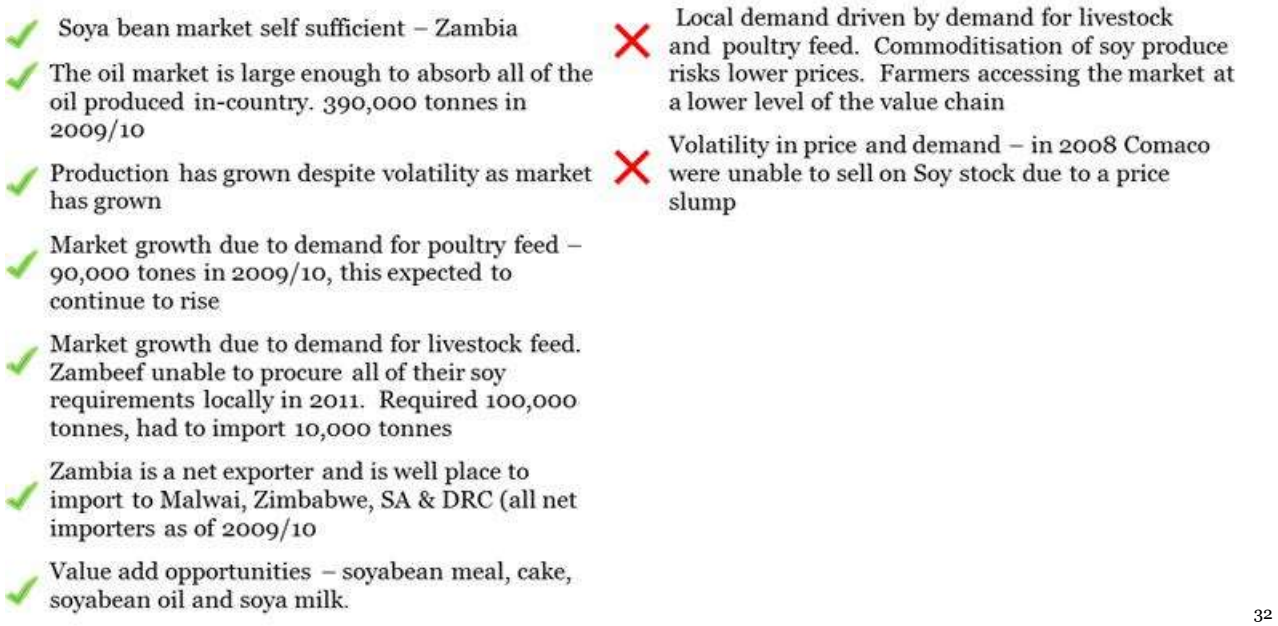
Additionally, increasing soya production using climate smart agricultural production can lead to biophysical and wider socio-economic resilience benefits. N-fixing perennials such pigeon peas can be interplanted with soya and maize in the 'double up legume system'. Pigeon peas produce significant biomass which replenishes the soil and reduces the risk of soil erosion and significantly provides the soil with carbon – enabling other crops grown with soya to use mineral fertiliser, helping farmers adapt to climate change.

3.2.1. Market demand for soya

Soya is a sound economic investment. A southern African study by Company S indicates that: "The soya industry has the potential to improve the lives of more than 400,000 smallholder farmers in Southern Africa, according to a seven-country study that offers a roadmap for developing the industry."[31]

[30] http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch9s9-4-4.html
[31] http://www.company S.org/press-room/detail/company S-study-shows-roadmap-for-soy-industry-growth-in-southern-africa

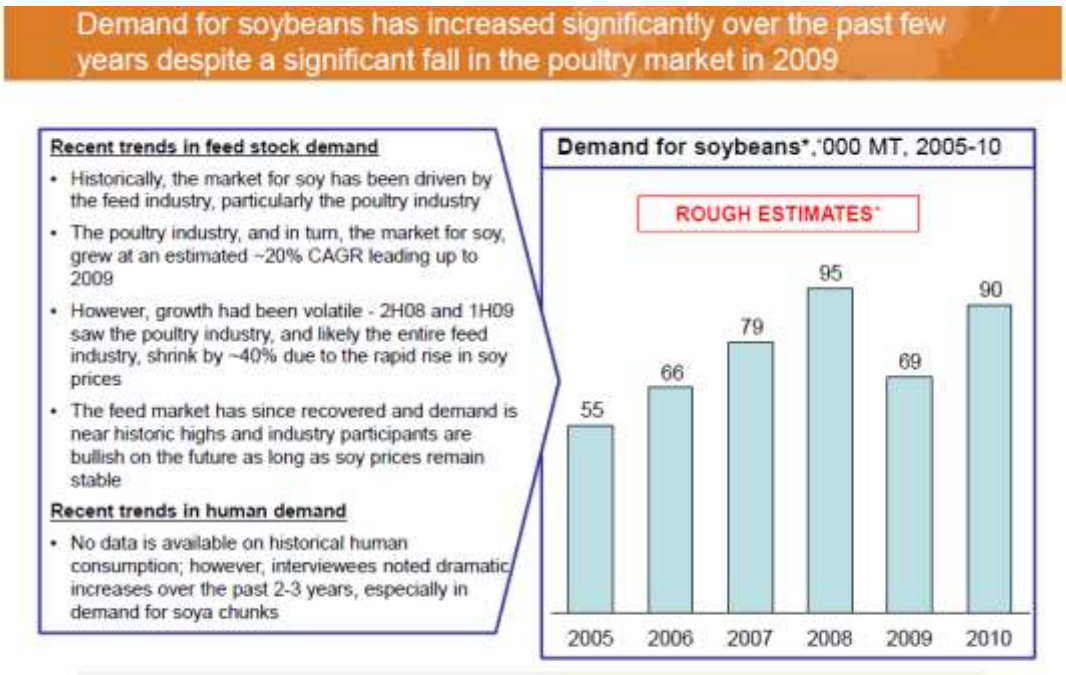
The global market for Soya is currently robust with regional and international demand for soya growing, and Zambia being traditionally one of the few net exporters of Soya in the region (although demand is starting to outstrip supply – Mozambique, DRC, Angola are all net importers and Malawi is poised to become a net importer. In 2012 Zambia produced 223, 000 tonnes of soya and this was insufficient to meet local and regional demand.



Demand for Soya is growing within Zambia, with the companies with high demand for Soya such as companies H and I demanding a significant proportion of annual production. In 2011, company H were unable to source all of the Soya they required locally, and had to import 10,000 tonnes.

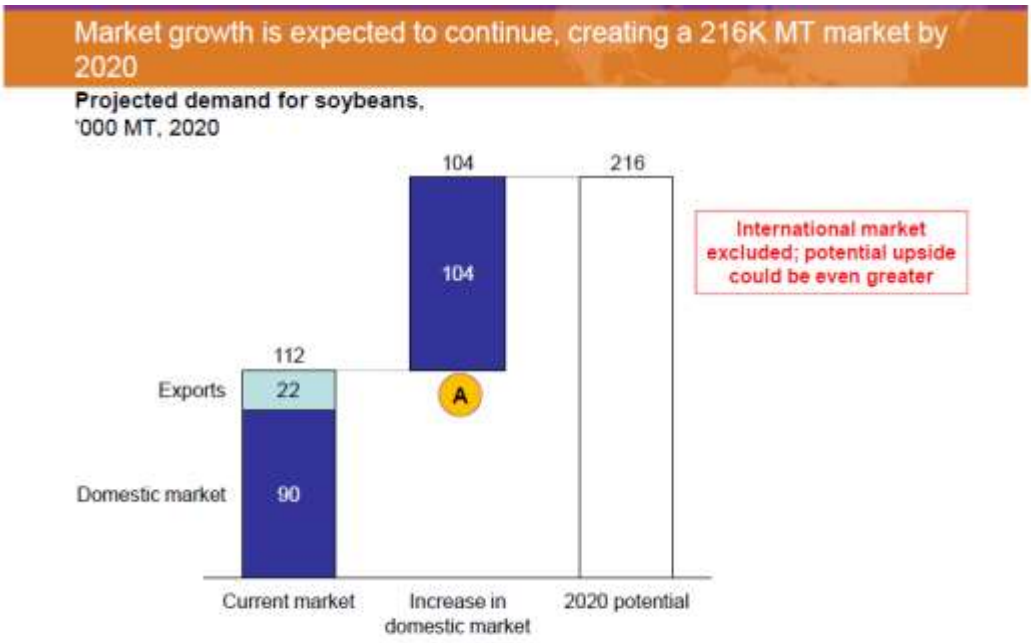
If local demand continues to grow as predicted, Zambia will not be able to take advantage of its current position as a net exporter in order to service regional markets. The majority of soya (85%) being produced by commercial farmers. In the face of this shortfall, there is an opportunity to scale production through smallholder farmers adopting climate-smart production methods.

[32] The South African Soybean Value Chain



[33]

The market is expected to grow driven by a combination of factors: growth in the livestock market (poultry and pork) and the associated increased demand for feed; increasing demands from the regional market and a large edible oils market – which could be provided for in soya oil.



This intervention has been developed, to support smallholder farmers gain access to market, and in particular being linked to large scale off-takers (such as companies H and I).

As described, all soya grown as part of this intervention would be grown using climate smart agriculture techniques – which provide the benefits of; increased yields of subsistence and cash crops; enhances biophysical resilience of the farming system to extreme weather events through restoration of soil quality; and GHG mitigation benefits in soils.

[33] Company S Southern African Roadmap – Zambia, p18

IFC could support this intervention by taking the following approaches:

1. By providing a credit line to smallholder farmers specifically adopting 'climate-smart soya' via the access to finance intervention. The direct recipient of the PPCR funds in this context could be the banks (i.e. companies A, B or C).

2. By providing concessional finance to agricultural processors in the soya supply chain (i.e. companies H and I) to develop smallholder extension services and logistical networks.

3. By providing grant finance to NGO extension service providers (i.e. company AC) to develop and roll out the Farm Business Advisor (FBA) model targeted specifically as smallholder climate-smart soya.

3.2.2. Current challenges Faced

3.2.2.1. Existing biophysical challenges

Rural farmers in Zambia face a number of biophysical challenges, when adopting traditional practices and without access to farm inputs such as fertilizers and irrigation technologies. The majority of smallholder farmers are reliant on rain-fed production of subsistence crops such as maize and cassava. Reliance on these crops presents challenges: yields are typically low (1 tonne, per hectare, per year) and nutritional value of these crops is usually minimal. The lack of diversity of crops results in rural households having a diet of low nutritional quality and can often be insufficient to meet household subsistence food needs particularly in the 'hunger months' between December and March, when rural populations with a single cropping season are especially at risk.

Traditional farming practices can be unsustainable. The combination of maize mono-cropping, annual cultivation of the same parcels of land and burning of crop residues depletes the nutritional quality of soils, pushing yields down. These practices also contribute to the release of GHGs such as carbon dioxide, methane and nitrous oxide (CO_2, CH_4, and N_2O) - from vegetation and soils into the atmosphere. Where excess land is available, nutrient depletion can temporarily be overcome, by clearing forests or other shrub vegetation to establish new land holdings. However, this short-term coping mechanism is a key driver of deforestation in the region, contributing to biodiversity loss, ecosystem degradation (and reduced resilience) and the release of GHGs. The level of damage these practices can cause can be seen across Zambia, but are particularly acute in over settled and encroached GMA's.

The impact of these activities leading to deforestation is significant. The FAO estimates that *"On average annual rate of forest loss in Zambia is between 250,000 ha and 300,000 ha/year and that 90% of forest loss results from establishment of agricultural lands. Much of this is driven at smallholder level"* (PEZP, 1998). Other studies indicate an annual average loss of up to about 850,000 ha"[34]. This deforestation results in increased levels of soil erosion, increasing rates of loss of bio diversity (flora and fauna) and increased levels of farmers moving onto new pieces of land to farm –thus increasing the rate of deforestation.

Where excess land is not available (potentially due to high population pressures), depletion of soil condition leads to declining yields. It also contributes to the fragility of the system: increased soil erosion, reduced water holding capacity, and reduced microbial life in soils.

3.2.2.2. Climate change challenges

Climate variability and climate change impacts pose significant threats to food security of smallholders reliant on subsistence production from such rain-fed systems. As described in the SPCR for Zambia, the country is already experiencing effects of increasing temperature and erratic rainfall – if vulnerable groups are not provided with climate change adaptation strategies and interventions to be able to respond successfully.

As average temperatures increase, maize yields are predicted to decline further, farmers mono cropping maize are expected to be even more vulnerable to food security issues. Small Smallholder systems are particularly vulnerable to the biophysical impacts of extreme weather events (which are predicted to increase in frequency

[34] http://www.fao.org/docrep/ARTICLE/WFC/XII/1022-B1.HTM

as a consequence of climate change) such as droughts, floods, pest outbreaks, and irregular seasonal rainfall patterns. In years with extreme weather events, such as extended drought or heavy floods – yields can be wiped out altogether.

Heavy rain or flooding, can also lead to severe soil erosion, particularly in sloped areas or areas seriously impacted by deforestation. If the soil erosion occurs close to waterways – it can be washed into the water as silt, causing additional damage. Eroded soil also has a low soil organic carbon (SOC), which results in limited water holding capacity – which makes impact soil and land particularly vulnerable to droughts.

3.2.2.3. Market challenges

Rural smallholder farmers face significant market challenges, in terms of being able to bring their produce to market. These challenges limit livelihood development opportunities. Assuming the farmer is mono-cropping maize then there is limited market opportunity available to the farmer. The government maize subsidy programme, caps the price per tonne that can be achieved and the farmer has poor access to markets. Each 50 kilo bag of maize is limited to 65,000 Zambian Kwacha ($13) a bag. On a relatively poor performing 5 hectare plot, producing 50 bags of maize would only yield the farmer 3, 250,000 Zambia Kwacha ($650) a year.

Reliance in these types of subsistence agricultural systems means that the farmers experience challenges when trying access finance and inputs (e.g. fertilisers, seeds etc).

Access to finance and inputs is made more challenging in situations where smallholder farmers lack organisational structure. Often the transaction costs associated with reaching these types of farmers prevent commercial lenders or agric-input providers from accessing them effectively

3.2.3. Impact of Challenges

The impact of these challenges is potentially catastrophic. Food security will be impacted from a regional to national level. The impact of food insecurity issues can result in either forced migration from rural to urban areas, or rural migration to areas that to-date have not been negatively impacted by damaging farming practices. An example of damaging rural migration is witnessed, by the encroachment and over settling of Game Management Areas (GMA's) , resulting in serious depletion of the GMA's.

Food insecure households are likely to turn to environmentally damaging short term coping strategies during times of low food availability. This could include increased charcoal production or other natural resource extraction. Over time this will negatively impact watershed functioning, biodiversity, and drive further GHG emissions, reducing ecosystem resilience further.

Given the significance of the agriculture sector in Zambia, and the proportion of smallholder rain-fed farmers vulnerable to these risks, economic development at a national level will be severely negatively impacted, if this is not addressed.

3.2.4. Intervention Description

Key features of the intervention are:

- Smallholder farmers supported to use 'climate smart' agricultural methods to grow soya for sale to off takers;
- Terms and conditions being part of the scheme tied to environmentally responsible behavior. Clients engaged in activities that contribute to deforestation or climate variability – i.e. charcoal burning & deforestation are not able to access the loan. Similarly those who do not comply to the soya standards can have their ability to sell stock to the aggregator restricted;

- Aggregated soya produce sold to the off-takers by the Farmer Business Advisor (FBA). FBA receives commission from the off-taker;
- Partnership with company AC, based on their Farmer Business Advisor model and methodology;
- **Farmer Business Advisor** to provide extension services to farmer, remunerated through commissions – dependent on farmers performance, from
    - Financial institutions on successful loan repayments
    - Agro dealers from inputs are sourced
    - Aggregators, and
- Opportunity to pilot carbon market / Payment for ecosystem service mitigation methodologies for soil and tree carbon sequestration benefits of 'climate-smart' agricultural production, using VCS SALM or Plan Vivo SHAMBA methodologies.

The farmers would need to belong to one of the networks of organised smallholder farmers to be able to access the scheme, and it is assumed that the farmers would access extension and credit facilities via the Access to Finance intervention. As part of the extension services, farmers would be linked to off-takers, who would commit to taking the soya produce. Farmers could also be linked to climate resilient input providers e.g. micro-irrigation systems to support soya seed production amongst lead farmers, greenhouse technologies for production of soya seed, and vegetables as a side product etc).

Soya has been selected due to the suitability of its production in 'climate-smart' double up legume systems (see climate rationale below), and due to the strong market for the commodity in the region.

Soya provides an opportunity to link formally with large agro-processors in Zambia demanding soya for production of vegetable oils, chicken feed and other soya cake products for export regionally. Currently demand for soya in the region significantly outstrips supply. This is partly driven by restrictions on use of GM soya products in Zambia (and Tanzania, Zimbabwe, Malawi) which in turn limits imports of GM soya products from countries with excess production (e.g. Brazil). Many countries in the region are net importers of soya- suggesting a significant unrealised market opportunity for soya farmers.

Many commercial farms in Zambia are starting to take advantage of this opportunity, but production at smallholder level is limited due to: lack of knowledge, lack of direct market access, lack of inputs required, and lack of access to finance.

The climate-smart system promoted could be the 'double up legume system' in which farmers are able to grow nutrient and protein rich pigeon peas – which can be stored and consumed during the 'hunger months' between December and March:

"In doubled-up legume systems, which have now been adopted by more than 8,000 households in Malawi1, farmers grow perennial pigeon pea along with annual legumes such as soya beans (Glycine max) or groundnuts. After harvesting the legumes, farmers plant maize in or beside the rows of pigeon peas and then harvest both. Farmers can use different types of pigeon pea, depending on how much grain they need for food and leaves and stems for animal feed or manure. They can also change the timing and arrangement of planting to favour the maize or the legume. Nutrient- and protein-rich, pigeon peas can persist into the drier months, after maize stocks have been exhausted9, and they can substantially improve families' diets". ***[Glover et al, 2012]***[35]

Lessons could be learned from the Anchor Farm project in Malawi, which is being implemented by the Clinton Foundation as a commercial operation, and currently supports over 10,000 smallholder farmers in production of maize/soya in rotation using such systems. (See case study project included in **Appendix A8**)

Maize yields under the programme have improved from approx 1.5t/ha/yr ->4+t/ha/yr, as a result of improved soil quality, and access to high quality farm inputs. In addition yields of soya average approx 2.6t/ha/yr.

There does need to be consideration of compliance to soya production standards. In the case of soya there are a few key ones, with regard to soya production: RTRS (Responsible Roundtable on Responsible Soy and Round

[35] ***[Glover et al, 2012]***

table on Sustainable Bio fuels (where soya is used for production of bio-diesels). In the event where you would proceed with this sub-sector, national interpretation of the RTRS in Zambia would be required

3.2.5. Climate Change Rationale

Adopting 'climate-smart' agricultural practices can lead to sustainable increases in yields, enhanced biophysical resilience of agricultural systems (i.e. through improved water holding capacity of soils, reduces susceptibility to soil erosion), and deliver mitigation 'co-benefits' through sequestration of carbon in trees and soils. The climate change rational of a combined agro forestry and conservation agricultural system is described in more detail below:

"Perennials can gain access to more of the soil's nutrients and water, for a longer time than annual crops. Their roots often extend more than two meters deep (compared with less than a metre for most annuals), and their growing seasons are longer. These attributes make them more resilient to harsh environmental conditions. Because they produce more biomass, both above and below ground, they are better at reducing soil erosion, transferring organic inputs to soil microorganisms and increasing the amount of carbon stored in the soil — a key component of soil health. These organic inputs and microorganisms then improve soil fertility and structure as well as increase water infiltration and storage — all of which increase the amount of water available to and used by crops. Moreover, by supplying the soil with carbon, perennials can improve the ability of food crops to use mineral fertilizers and, potentially, help farmers to adapt to climate change." ***[Glover et al 2012]***

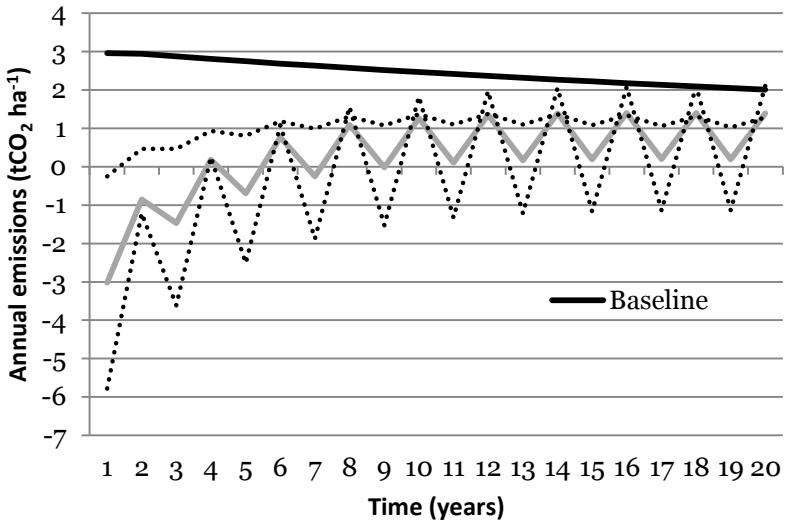
In addition to the adaptation/climate resilience rationale, there is also mitigation rational as carbon is sequestered in perennials and soils above the baseline levels.

Below is an example of the mitigation potential of soya/maize rotation conservation agriculture system being promoted in Mchinji district, Malawi. This has been estimated using the Small Holder Agriculture Monitoring and Baseline Assessment (SHAMBA)[36] tool.

Mitigation potential of smallholder 'climate-smart' soya production based on farming system adopted by participants in the Anchor Farm project, Mchinji District Malawi. Predicted baseline and project emissions per hectare (dotted lines above and below project soil carbon indicate stocks under high and low yield scenarios):

Total mitigation potential (t CO_2e ha^{-1})	44.47 (range 28.87 – 56.74)
Annual mitigation potential (t CO_2e ha^{-1} yr	2.22 (range 1.44 – 2.83)

[36] The SHAMBA tool, methodology and user guide constitutes a smallholder agriculture mitigation benefits accounting framework that has. developed by PwC and Edinburgh University supported by a grant from the Rockefeller Foundation



- Key points to note include, the mitigation potential from this type of system is largely driven by yield increases and soil type. The higher the clay proportion of soils and lower the baseline level of SOC the greater the mitigation potential. Improved higher yields generate increases in volumes of crop residues which can be incorporated into soils and ultimately drive SOC accumulation.

- As soya and perennial crops such as *Gliricidia, Tephrosia* etc are N-fixing, these contribute to N2O emissions when grown. This explains the annual fluctuations in mitigation potential in the above graph.

There is an opportunity to pilot generation of Payment for Ecosystem Service certificates (PES) using the Plan Vivo Standard, under which the SHAMBA methodology, tool and user guides have been submitted for peer review and approval. [37]. This could complement a landscape level REDD+ accounting approach.

The World Bank Biocarbon fund and other donors are exploring opportunities to develop landscape projects that incorporate CSA practices as a means of addressing the drivers of wider land degradation, whist sequestering carbon in on farm trees and soils as a co-benefit. They are potentially open to use of innovative CSA accounting approaches (such as that employed under SHAMBA) to account for the mitigation benefits of smallholder CSA. There is an opportunity to leverage these approaches within the context of this soya intervention – providing a potential additional revenue stream for the smallholder farmers.

This intervention has multiple adaptation benefits including:

- Higher yields due to nitrogen, and potentially higher maize yields if rotate with the soya – a well managed 2 hectare plot can produced 200 bags of maize (personal communications);
- Increased resilience of communities to climate variability and climate change – via both the effective management of soil quality and the potential to realise benefit from the enhanced soil via the carbon markets;
- Access to a robust soya market by the smallholder and emergent farmers;
- Provide a basis via which the farmers can access new technologies, such as treadle pumps, drip irrigation or greenhouse technologies via the combination of the Soya and Access to Market interventions;
- Conservation farming methods enhance water holding capacity of soils, and reduce susceptibility to the impacts of flooding and soil erosion;
- A basis with which the farmers can access finance, via the Access to Finance intervention. If for example, a farmer was able to procure drip irrigation – they could further enhance their agricultural output by combining vegetables with the soya and maize produce; and

[37] The SHAMBA tool, methodology and user guide constitutes a smallholder agriculture mitigation benefits accounting framework that has. developed by PwC and Edinburgh University supported by a grant from the Rockefeller Foundation
[37] ibid

- Reduction of the need to open up new land for agricultural purposes. Where you facilitate conservation farming, agricultural permanence, facilitate markets - it is possible to encourage permanence and reduce wildlife /human conflict.

3.2.6. PPCR Results Framework

The intervention will improve the quality of life for people living in some of the most vulnerable situations globally in terms of the impact of climate change. The intervention has the potential to significantly boost household food security, and enhance socio-economic and biophysical resilience to climate change impacts.

The use of climate resilient practices and technologies (i.e. irrigation for production of soya seed), especially if coupled with micro-insurance products for Soya, has the potential to reduce economic losses by smallholder farmers in the face of extreme weather events.

The intervention presents an opportunity to leverage new sources of finance and resource from the private sector in terms of: smallholder lending products (see A2F intervention), technical resources of agri-input company field staff and technicians, potential private and public sector investments in PES certificates associated through CSA mitigation project development.

As the majority of smallholder farmers in Zambia are women, the intervention has the potential to deliver significant gender equality benefits.

3.2.7. Investment description

It is proposed that this intervention is structured to leverage the Access to Finance investment, in the context of smallholder and emergent farmers working their own plots of land, and buying inputs and equipment, predominately on an individual basis. The intervention depends on the following criteria:

- Investment of resources and logistics to collect aggregated stock from the Farmer Business Advisory by the off-taker
- Investment via Agricultural Finance (Access to Finance) by the farmers
- Technical support to launch the intervention by IFC - possibly as a component of a wider Programmatic Integrated Intervention.

In order to participate in these interventions farmers will have to :

- Be a member of a co-operative (ZNFU, CFU, or co-operative set up to facilitate the intervention)
- Commit to climate smart agricultural techniques
- Commit to positive land use practices (i.e. not charcoal burning, no poaching)

IFC would be able to support this intervention by taking the following approaches:

1. Providing a credit line to smallholder farmers specifically adopting 'climate-smart soya' via the access to finance intervention. The direct recipient of the PPCR funds in this context could be the banks and it may be that the banks are more interested in risk sharing than being provided with a credit line.

2. Providing concessional finance to agricultural processors in the soya supply chain to develop smallholder extension services and logistical networks.

3. Providing grant finance to NGO extension service providers (i.e. company AC) to develop and roll out the Farm Business Advisor (FBA) model targeted specifically as smallholder climate-smart soya.

3.2.8. Economic Analysis

In this section we detail the type of economic benefit this intervention can deliver to farmers, and so to the financial institutions providing credit lines to the farmers. By way of illustration all figures below are provided in contrast to maize produce.

Criteria	Details		
	Soya (Conservation)	**Maize (Conventional)**	**Maize (Conservation)**
Price per tonne of produce – US $	US $540	US $200	US $200
Price per kg of produce - Kwacha	2,700	1,000	1,000
Average yield – Kg/ha	2,000	2,500	5,000
Area planted	1ha	1ha	1ha
Input costs	Based on ZNFU enterprise budget		
Labour cost	12,200 per man day		
Transportation costs to collection depot – Farmer	US $0.20 per km/tonne for 75km		
Transportation costs to processing facility	Ignored as should be borne by off taker		
Weather based insurance premiums	8% of the crop value		
Exchange rate	K5,000/US $ - assumed a constant over the 5 years		
Inflation	Ignored		
Taxation	Ignored		

The application of inputs and timing are detailed below:

Application period per product

	October	November	December	January	February	March	April	May	June	July	August	September
Soya (ZNFU)												
Seed	-	672,000	-	-	-	-	-	-	-	-	-	-
Soya		100%										
Maize												
Fertilizer	-	-	356,000	-	-	-	-	-	-	-	-	-
Compund D			100%									
Urea												
-												
Chemicals	-	311,900	50,456	50,456	-	-	-	-	-	-	-	-
Soy Flow		100%										
Round up			50%	50%								
Seed plus		100%										
Inceticides - Endosuphan			50%	50%								
Inceticides - Actellic Super												
Inceticides - Actellic												
-												
	-	256,200	128,100	128,100	-	-	341,600	-	-	-	-	-
Labour costs		30%	15%	15%			40%					
Land preperation												
Planting												
Input application												
Weeding												
Harvesting and bagging												
-												
	-	250,000	-	-	-	-	-	-	-	-	-	-
Ploughing cost		100%										
-												
	-	-	-	-	-	-	-	80,000	-	-	-	-
Packaging material								100%				
-												
	-	-	-	-	-	-	-	150,000	-	-	-	-
Transport costs								100%				

Maize (Conventional)

	October	November	December	January	February	March	April	May	June	July	August	September
Seed	-	228,000	-	-	-	-	-	-	-	-	-	-
Soya												
Maize		100%										
-												
Fertilizer	-	534,000	525,000	-	-	-	-	-	-	-	-	-
Compund D		100%										
Urea			100%									
-												
Chemicals	-	-	54,520	-	-	-	-	-	-	-	-	-
Soy Flow												
Round up												
Seed plus												
Inceticides - Endosuphan												
Inceticides - Actellic Super			100%									
Inceticides - Actellic												
-	-	183,000	183,000	-	-	-	-	122,000	122,000	-	-	-
Labour costs		30%	30%					20%	20%			
Land preperation												
Planting												
Input application												
Weeding												
Harvesting and bagging												
-												
	-	250,000	-	-	-	-	-	-	-	-	-	-
Ploughing cost		100%										
-												
	-	-	-	-	-	-	-	-	100,000	-	-	-
Packaging material									100%			
-												
	-	-	-	-	-	-	-	-	-	187,500	-	-
Transport costs										100%		

Maize (Conservation)

	October	November	December	January	February	March	April	May	June	July	August	September
Seed	-	285,000	-	-	-	-	-	-	-	-	-	-
Soya												
Maize		100%										
-												
Fertilizer	-	890,000	525,000	-	-	-	-	-	-	-	-	-
Compund D		100%										
Urea			100%									
-												
Chemicals	-	-	73,130	73,130	-	-	-	-	-	-	-	-
Soy Flow												
Round up			50%	50%								
Seed plus												
Inceticides - Endosuphan												
Inceticides - Actellic Super												
Inceticides - Actellic			50%	50%								
-												
	-	256,200	128,100	128,100	-	-	-	170,800	170,800	-	-	-
Labour costs		30%	15%	15%				20%	20%			
Land preperation												
Planting												
Input application												
Weeding												
Harvesting and bagging												
-	-	-	-	-	-	-	-	-	-	-	-	-
Ploughing cost												
-	-	-	-	-	-	-	-	-	200,000	-	-	-
Packaging material									100%			
-	-	-	-	-	-	-	-	-	-	375,000	-	-
Transport costs										100%		

Soya cash flow:

Summary cash flow per farmer - Soya

ZMK	October	November	December	January	February	March	April	May	June	July	August	September	Total
Revenue	-	-	-	-	-	-	-	5,400,000	-	-	-	-	5,400,000
Other income													-
Total cash inflows	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5,400,000**	**-**	**-**	**-**	**-**	**5,400,000**
Seed	-	672,000	-	-	-	-	-	-	-	-	-	-	672,000
Fertilizer	-	-	356,000	-	-	-	-	-	-	-	-	-	356,000
Chemicals	-	311,900	50,456	50,456	-	-	-	-	-	-	-	-	412,813
Labour	-	256,200	128,100	128,100	-	-	341,600	-	-	-	-	-	854,000
Ploughing costs	-	250,000	-	-	-	-	-	-	-	-	-	-	250,000
Packaging materials	-	-	-	-	-	-	-	80,000	-	-	-	-	80,000
Transport	-	-	-	-	-	-	-	150,000	-	-	-	-	150,000
Insurance		432,000											432,000
Total cash outflows	**-**	**1,922,100**	**534,556**	**178,556**	**-**	**-**	**341,600**	**230,000**	**-**	**-**	**-**	**-**	**3,206,813**
Net cash flows / funding requirements	**-**	**(1,922,100)**	**(534,556)**	**(178,556)**	**-**	**-**	**(341,600)**	**5,170,000**	**-**	**-**	**-**	**-**	**2,193,188**
Cash brought forward	-	-	(1,922,100)	(2,456,656)	(2,635,213)	(2,635,213)	(2,635,213)	(2,976,813)	2,193,188	2,193,188	2,193,188	2,193,188	-
Cash carried forward	**-**	**(1,922,100)**	**(2,456,656)**	**(2,635,213)**	**(2,635,213)**	**(2,635,213)**	**(2,976,813)**	**2,193,188**	**2,193,188**	**2,193,188**	**2,193,188**	**2,193,188**	**2,193,188**

Internal Rate of Return	**194%**
Payback	**7 months**
Breakeven price - ZmK/kg	**1,603.41**
Breakeven yield - Tonnes/ha	**1.19**
Return on Intestment	**68%**

Maize Conventional Farming:

Summary cash flow per farmer - Maize - Conventional

ZMK	October	November	December	January	February	March	April	May	June	July	August	September	Total
Revenue	-	-	-	-	-	-	-	-	-	2,500,000	-	-	2,500,000
Other income													-
Total cash inflows	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,500,000**	**-**	**-**	**2,500,000**
Seed	-	228,000	-	-	-	-	-	-	-	-	-	-	228,000
Fertilizer	-	534,000	525,000	-	-	-	-	-	-	-	-	-	1,059,000
Chemicals	-	-	54,520	-	-	-	-	-	-	-	-	-	54,520
Labour	-	183,000	183,000	-	-	-	-	122,000	122,000	-	-	-	610,000
Ploughing costs	-	250,000	-	-	-	-	-	-	-	-	-	-	250,000
Packaging materials	-	-	-	-	-	-	-	-	100,000	-	-	-	100,000
Transport	-	-	-	-	-	-	-	-	-	187,500	-	-	187,500
Insurance		200,000											200,000
Total cash outflows	**-**	**1,395,000**	**762,520**	**-**	**-**	**-**	**-**	**122,000**	**222,000**	**187,500**	**-**	**-**	**2,689,020**
Net cash flows / funding requirement	**-**	**(1,395,000)**	**(762,520)**	**-**	**-**	**-**	**-**	**(122,000)**	**(222,000)**	**2,312,500**	**-**	**-**	**(189,020)**
Cash brought forward	-	-	(1,395,000)	(2,157,520)	(2,157,520)	(2,157,520)	(2,157,520)	(2,157,520)	(2,279,520)	(2,501,520)	(189,020)	(189,020)	-
Cash carried forward	**-**	**(1,395,000)**	**(2,157,520)**	**(2,157,520)**	**(2,157,520)**	**(2,157,520)**	**(2,157,520)**	**(2,279,520)**	**(2,501,520)**	**(189,020)**	**(189,020)**	**(189,020)**	**(189,020)**

Internal Rate of Return	**(12%)**
Payback	**9 months**
Breakeven price - ZmK/kg	**1,076**
Breakeven yield - Tonnes/ha	**2.69**
RoI	**(7%)**

Maize Conservation Farming:

Summary cash flow per farmer - Maize - Conservation

ZMK	October	November	December	January	February	March	April	May	June	July	August	September	Total
Revenue	-	-	-	-	-	-	-	-	-	5,000,000	-	-	5,000,000
Other income													-
Total cash inflows	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5,000,000**	**-**	**-**	**5,000,000**
Seed	-	285,000	-	-	-	-	-	-	-	-	-	-	285,000
Fertilizer	-	890,000	525,000	-	-	-	-	-	-	-	-	-	1,415,000
Chemicals	-	-	73,130	73,130	-	-	-	-	-	-	-	-	146,260
Labour	-	256,200	128,100	128,100	-	-	-	170,800	170,800	-	-	-	854,000
Ploughing costs	-	-	-	-	-	-	-	-	-	-	-	-	-
Packaging materials	-	-	-	-	-	-	-	-	200,000	-	-	-	200,000
Transport	-	-	-	-	-	-	-	-	-	375,000	-	-	375,000
Insurance		400,000											400,000
Total cash outflows	**-**	**1,831,200**	**726,230**	**201,230**	**-**	**-**	**-**	**170,800**	**370,800**	**375,000**	**-**	**-**	**3,675,260**
Net cash flows / funding requirements	**-**	**(1,831,200)**	**(726,230)**	**(201,230)**	**-**	**-**	**-**	**(170,800)**	**(370,800)**	**4,625,000**	**-**	**-**	**1,324,740**
Cash brought forward	-	-	(1,831,200)	(2,557,430)	(2,758,660)	(2,758,660)	(2,758,660)	(2,758,660)	(2,929,460)	(3,300,260)	1,324,740	1,324,740	-
Cash carried forward	**-**	**(1,831,200)**	**(2,557,430)**	**(2,758,660)**	**(2,758,660)**	**(2,758,660)**	**(2,758,660)**	**(2,929,460)**	**(3,300,260)**	**1,324,740**	**1,324,740**	**1,324,740**	**1,324,740**

Internal Rate of Return	**70%**
Payback	**9 months**
Breakeven price - ZmK/kg	**735**
Breakeven yield - Tonnes/ha	**3.68**
RoI	**36%**

Summary of results

	Soya (Conservation)	Maize (Conventional)	Maize (Conservation)
Internal Rate of Return	194%	(12%)	70%
Net pre finance cost cash position	2,193,188	(189,020)	1,324,740
Additional income from soya (K)		2,382,208	868,448
Payback period (months)	7	9	9

3.2.9. Operating Requirements

It is assumed in this intervention, that operationally the extension service and aggregation of produce for the off-taker is via the same Farmer Business Advisor, using the same methodology described in the Access to Finance intervention.

3.2.10. Market, financial and technical risks involved

- Off-takers need to be confirmed contractually. Without access to markets, farmers could end up with produce that they cannot sell.
- Impact of fluctuating prices. Slump in soya production possible if there is a price slump. In 2008 there was a price crash – farmers who were negatively impacted did not grow soya the next year.
- Commodity price challenge – as commodity prices can be low and commodity prices have a risk of falling.
- In the context of the GMA's there is a risk that a successful Soya/Maize intervention could lead to further investment - although it also argued that the implementation of successful conservation/climate smart

interventions will result in less land movement – particularly if farmers have also invested in an irrigation system, thus reducing encroachment pressures. These interventions would enable farmers to have permanent fields thus reducing the need to open up new land for agricultural purposes.

- The level of extension services to be delivered must not be underestimated. Farmers need to be clear on the benefits and the timeline for delivery.
- Off taker needs to guarantee that all soya will be taken to market. This is critical to underpinning lending arrangements with commercial lenders.
- Risk that soya stocks traded on the commodity market will not enable smallholder farmer to access higher levels of the value chain.
- An untapped soya market is for soya oil. This is high value oil – with a potentially large market. In 2011, the demand for edible oil was 339,000 tonnes – which if converted to soya oil would take more than the entire soya produced nationally.

3.2.11. Challenges/ Critical Success Factors

- **Availability of reliable large buyers willing to sign and honour pre-season supply contracts** – soya crop is currently sold to agro-processer companies, producing fish feed in Malawi, whilst maize supply contracts have been agreed with a South African based grain trader. Contracts are negotiated in the pre-season when market prices are at their highest, providing smallholders with a secure forward price against which to plan season's activities. At harvest, smallholder crop produce is collected and stored at the anchor farm warehouse, before being shipped to the buyer.
- **Farmer access to high quality farm inputs, including fertiliser, pesticides, herbicides and seeds** - these are procured through the anchor farm, and distributed at wholesale prices to smallholders through the farmer group structure.
- **Access to farm input loans** – the project has negotiated lending arrangements between local banks and smallholders. Farmer groups generate peer pressure amongst members for loan repayment
- **Drip irrigation is an appropriate technology -** but a key assumption for drip technology that there is a suitable water supply close enough to be able to install the irrigation.

3.2.12. Alternate Investment 1: Trees on Farms/Shared Value Africa[38]

Soya is not the only cash crop that has a strong market in Zambia. Cotton also has a strong commodity market with off-takers taking an interest in the small holder farmer segment. However, cotton is typically farmed in a manner that depletes the soil resulting in degradation of soil and challenges described in this section.

There is a private sector/NGO project that seeks to link climate-smart agriculture with cotton farming, by introducing nitrogen fixing trees. This project is also linked to the climate resilience challenges around energy and charcoal burning – by an intervention to use cotton agricultural waste to produce energy efficient briquettes that can be used as charcoal replacements.

[38] Concept submitted by Green Knowledge Initiative/Shared Value Africa

We propose the intervention below as an alternate climate-smart agricultural invention for consideration by the IFC.

To provide viable options for Zambian small-scale farmers to improve their resilience to environmental change and increase crop yields through improved sustainable farming practices focusing on agro forestry

Project Sponsor and Manager
Company M is a Zambian registered company limited by guarantee implementing and investing in commercially driven projects that address socio-environmental risks through equitable partnerships and that meet the pressing need for energy, access to finance, nutrition, health and communications in low-income communities throughout Africa

Project Partners
Company L is a Zambian cotton ginning company, managing and investing in an out-grower scheme of over 150,000 farmers. Musika is a non-profit company limited by guarantee established to provide world class business development services to Zambia's agricultural markets to deepen and broaden the impact of economic growth to all levels of rural society.

Climate-smart Agriculture Programme
Company M is developing and commercialising projects that contribute to climate smart development using novel finance mechanisms such as the carbon markets. Company M has a number of projects at various stages of development in Zambia, which is expected to reach 100,000 farmers in the next three years. Company M actively engages small-scale farmers throughout rural Zambia to promote sustainable intensification of cotton and food crops using conservation agricultural techniques including agro forestry inter-cropping with nitrogen-fixing leguminous trees.

Key species include the long-lived and large Faidherbia albida –particularly well suited to planting directly in the crops as it drops its leaves and becomes dormant during the growing season – as well as faster growing species such Gliricidia sepium. Compared to traditional agricultural practices, this approach achieves higher crop yields, decreases erosion, improves soil structure and increases levels of soil nutrients, organic matter and carbon, factors resulting in higher levels of food security and resilience to climate shocks such as droughts and floods. SVA has partnered with leading local and US research institutions to explore and enhance adoption of these species in order to continuously improve the programme. Combining slow and fast growth tree species provides short, medium and long-term benefits to farmers and gives rise over time to a dominant Faidherbia landscape. In addition to improved crop yields, this provides an added benefit of potentially significant above and below-ground carbon sequestration in biomass, providing an important stream of revenue that builds in financial sustainability to programs promoting conservation farming combined with agro forestry, and can supplement farmer income directly. Company M is looking to develop this project in 2013 under a voluntary carbon standard to realize the potential of linking smallholders to the carbon markets. Faster growth species will also provide farmers a cash crop by supplying the burgeoning market for renewable firewood used in improved cook stoves in urban area in Zambia. Potential markets for the farmers engaged in 2012 are Chipata, Lusaka and the Copper belt Province, each of which are large drivers of the deforestation of native forests in Zambia. Should this project be moved into another region, for example the Kafue sub-basin, markets in Lusaka and the Copper belt will be still be accessible.

We believe that the destruction of Zambia's natural forest estate puts great strain on household energy requirements in rural Zambia, and leads to an increased work load among rural women in collecting sufficient wood to cook the households' food needs. However, with little in the way of alternative energy sources, the rural and urban poor are forced to use wood-based energy and currently there are very few market-based mechanisms that tackle this problem.

Company M is planning to develop an innovative market linkage between its agricultural initiatives and the household energy needs of Zambians in the form of high-quality manufactured biomass briquettes that will help to decouple the rapidly-growing energy demand from non-renewable biomass sources. The briquettes will replace charcoal and wood used by households for cooking/heating and sourced from non-renewable stocks, and be made from renewable stocks or biomass derived from agricultural waste – such as cotton stalks which are often burnt in-field - sourced from smallholder's farmers to diversify incomes and incentivise sustainable agricultural practices such as agro forestry.

Company M has also recognised further market gaps that negatively impact rural and urban households. Company M is working to address these by creating, within the same networks, retail and novel distribution

channels for efficient cook stoves, water purification systems, solar lights and other products and EcoSac heat retention cooking bags, all of which will form components of a wider carbon project.

Investment Request

Company M is currently seeking financing to scale up its climate-smart agriculture programme beyond the Eastern and Central provinces, to make it a countrywide programme and to build further integrated market linkages. We are currently seeking financing partners to fund the carbon asset development as well as recruitment, training, follow-up and monitoring of rural farmers in best practices of agro forestry, and verifying their nitrogen fixing trees survive to ensure long-term climate resilience and improved food security. Furthermore, company M is seeking grants to establish an efficient distribution line and to pilot products that have high potential development impact, as well as investments (debt and/or equity) to manufacture or to import the necessary household energy products to reach a critical mass of households in Zambia.

Assessment

This intervention is appealing as is supports the resilience of a high value cash crop against the impact of drought and deforestation, in part caused by the farming practices associated with cotton. However, the dependency on this business model on the carbon credit market – raises the same issues about financial viability of this intervention, without grant support in the current carbon market climate.

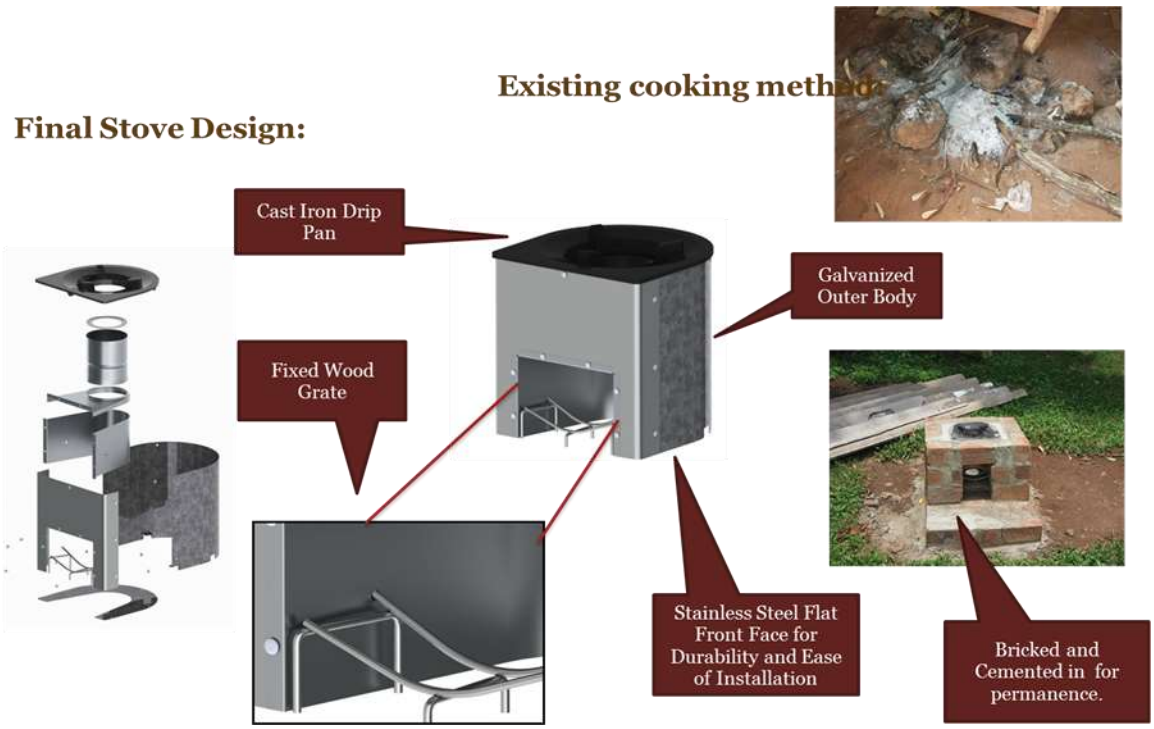
3.3. Promotion of renewable biomass fuels

The intention of the company AE's project is to install 50,000 energy efficient stoves across Zambia. These stoves are provided at no cost to the end user in Zambia although the unit cost of the stove is c.$40 with installation costing around an additional $5 according to location. They have deliberately chosen to distribute the stoves cost free to the recipient as that allows the focus to be on stove distribution rather than be hampered by supply and demand economics. The roll out began in July 2011 and current project period will finish in June 2013. Currently, some 24,000 stoves are installed and a further 16,000 are on order.

The project has the potential deliver significant Greenhouse Gas (GHG) emissions reductions of approximately 3 tonnes of CO_2 equivalent per stove per annum, resulting in an expected 660 thousand tonnes of Certified Emission Reductions (CERs) in total over the entire accreditation period, assuming the stove retains its efficiency and is still being used by the recipient. Early evidence gathered by the project team is suggesting usage levels of up to 90%.

The project can demonstrate potential for high levels of environmental, health and social co-benefits. In 2006 the Government Zambia set itself a target for 100% access to modern fuels by 2030[39]. At this time approximately 84% of all households in Zambia rely on biomass (wood and charcoal) for cooking. This figure rises to 98% in rural areas. As of 2009, just 0.4% % of the population that rely on solid fuels for cooking were using improved cooking stoves[40]. According to the WHO the health effects of indoor smoke released by burning solid fuels included 8,700 deaths from pneumonia, COPD and lung cancer in Zambia in 2004[41]. Other health-related impacts associated with biomass cooking include: burns and scalds from open fires or semi-open stoves; risk of injury and violence (primarily to women) while collecting wood; and missed time from school for older children involved in fuel collection. As well as leading to excessive environmental degradation and emissions, the time spent collecting solid fuel also imposes opportunity costs that constrain socio-economic development generally[42].

[39] Republic of Zambia. 2006. Fifth National Development Plan 2006-2010, PRSP
[40] Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia, and Macro International Inc. 2009. Zambia Demographic and Health Survey 2007. Calverton, Maryland, USA: CSO and Macro International Inc.
[41] From WHO 2009, Country profiles of environmental burden of disease, accessible at www.who.int/quantifying_ehimpacts/countryprofiles
[42] UNDP 2009, The Energy Access Situation in developing countries - A Review Focusing on the Least Developed Countries and Sub-Saharan Africa



3.3.1. Intervention Description

The project is funded by US$ 2.1 m of shareholder loans, which is has been sufficient to roll out 24,000 stoves, register the project with the UN and to cover start up costs. In addition a prepayment on an ERPA of US$1 million will fund the next 28,000 stoves.

Company AE has partnered with Africa Carbon Credit Exchange (ACCE). ACCE is a Zambian company regulated by the Securities and Exchange Commission of Zambia. Its founder and chairman is a former CEO of the Lusaka Stock Exchange and current chairman of the National Economic Advisory Council. ACCE's role is to provide advice and assistance with local issues in relation to the project

A team has been recruited and includes an experienced regional director and project manager, as well as a number of permanent and temporary staff.

The stoves are being supplied by Envirofit, a US-based company primarily funded by the Shell Foundation who have already supplied over 160,000 stoves to households in India.

A trust will be established whereby company AE will donate 5% of net sales to community projects.

The current status of the Stove Installation plan is as follows:

	Stoves Ordered	Stoves installed	Stoves Installed per week	% of households regularly using the installed stove
As of 1/11/2012	> 38,000	24,000	1,000	85% - 90%

To date project milestones include:

- Design documentation uploaded to the UNFCCC website
- First stove Order – December 2010

- Host Government Letter of Approval issued

Company AE now anticipate the project to be registered with the UNFCCC (http://cdm.unfccc.int/ProgrammeOfActivities/request_reg.html) in the first quarer of 2013 and for the first revenues to be received thereafter. The current project period should conclude by the middle of 2013.

3.3.2. Challenges/ Critical Success Factors

Given the deficit of efficient cooking facilities in Zambia it is suggested that a successful and proven project with an established distribution network such as company AE should offer itself for further investment to build it to scale.

That is likely to remain the case until CER prices rise back to at prices closer to 4-5 euros a metric ton, and this point in time this intervention is not considered financially viable.

3.4. Agro Processing/ Indigenous crop production

This opportunity relates to farmers' ability to access the value chain, providing locally produced goods into the local and international market.

The market for locally processed agricultural produce in Zambia has been demonstrated by the market success of companies N and O. In 2009, company N grew by 300% and has continued to grow as their product lines have been expanded over the years. In interview, company O commented that their challenge was less finding market to sell to and more the ability to find quality source of agricultural produce in order to meet demand. It is proposed that the beneficiary smallholder farmers, who are targeted for Access to Finance and the Soya intervention would be targeted as supplier farmers into the Agro processing plants.

Both companies N and O have identified local, regional and international market.

Company N

Company N has distribution agreements with Spar, Game, Shoprite, Pick and Pay to provide produce, and interest from the South African market via these brands. There is a plan to expand into the South African market but they currently feel they need to upscale production to respond to the local market. Company N acknowledged that there is a significant international market for high quality , Zambia produce (for example Zambian honey) - however felt that significant work required to get the appropriate accreditation needed to be established first, and possibly this could be an area where the IFC could support.

Company O

Company O said that the challenge was not the market but sourcing appropriate produce. It already export to the Zambian Diaspora abroad – products such as canned village chicken, soups and packaged vegetables, however were not able to quantify this market.

Company O has identified a significant market for starch products in the region. When company P did some research on company O's behalf, example orders included:

- Country A - wanted to order 200 tonnes of cassava chips per week[43]
- Country B - wanted to order 75 tonnes of cassava starch per week

The Zambian police force and military are all importing starch (maize meal, cassava and sweet potato) – demonstrating a large market that could be supplied locally. Similarly, Zambia breweries need glucose which can be extracted from cassava.

3.4.1. Current challenges Faced

- Smallholder farmers are unable to access the value chain and realise higher prices
- Low Yields due to inadequate agronomic skills
- Farmers are unable to feed their households and sell surplus resulting in poaching activities
- The same challenges identified for the Soya Intervention apply to smallholder farmers who are producing horticulture produce.

[43] Example orders, and verification of countries making the orders would need to be confirmed with companies O and P.

3.4.2. Impact of Challenges

The smallholder farmers who would benefit by being able to have their produce processed locally, thus benefiting from accessing the value chain – face the same challenges as those targeted by the Access to Finance and Soya Interventions. Suboptimal farming practices and variability in rainfall results leads to low yields. Currently, many smallholder farmers are encouraged to join the tobacco and cotton value chains, however whilst these programme are successful in enabling access to market and providing capital to farmers, these programmes are also believed to contribute to Zambia's high deforestation rate. Smallholders typically use variations of the traditional *chitemene* (clearing and burning) farming approach, changing plots every couple of years – contributing to Zambia's status as a country with one of the highest deforestation rates in the world.

If farmers are unable to link effectively into agricultural value chains, they remain vulnerable to contributing to deforestation, food insecurity and rely on other natural resources (fish, timber etc) as a coping mechanism. Even the farmers who are able to access the cotton and tobacco value chains remain vulnerable to global commodity price shifts – as was evidenced earlier in 2012, when cotton farmers in Mumbwa destroyed their cotton stock rather than sell it at the below expected price to the cotton off-taker, company L.

3.4.3. Intervention Description

This intervention is to provide agro –processing that is accessible to smallholder farmers, enabling them to access value chains, that provide financial benefit to the farmer s but also are able to support climate change adaptation (for example, soya bean, cowpeas, indigenous vegetables, sunflower, groundnuts etc).

There are two investments proposed for IFC's consideration:

1. Invest directly in company N's proposed manufacturing/agro processing hub in Lusaka where they will be able to provide a centralised service to multiple regions nationally, including the Kafue and Barotse sub-basins

2. Invest in company O's proposed Agro processing plant, located in the Kafue sub-basin near Mumbwa that is able to service local smallholder farmers as well being a central collection point of produce from the Western Province and surrounding region.

Both companies N and O have identified the power of the market to move smallholder farmers away from destructive agricultural practices. Company N pays premium prices for farmers who adhere to conservation/climate smart agriculture farming practices. Company O have presentations with farmers where it is highlighted that a 50KG bag of vegetables will fetch 425,000 - 500,000 Zambian Kwacha with a 50KG of maize only fetching 65,000 Zambian Kwacha.

3.4.3.1. Company N[44]

Company N is the commercial production of company R. Company R provides farmers with the support and the framework with which to access markets and in particular higher value chains. Vulnerable and communities subject to food insecurity – and therefore the most likely to burn charcoal or poach are directly targeted by company R.

Company R organises farmer into 'producer groups' who have to commit to positive/conservation farming practices, and **a formalised agreement** between the producer group and company R. The agreement to adhere to sustainable land use practices qualifies the farm for conservation dividends (rewarding the farmer). Engagement with the communities is via the chiefs who help identify communities who are more vulnerable. Company R initially engages the community via awareness and sensitisation, and then recruits farmers. The

[44] http://www.pnas.org/content/108/34/13957.full

agreement is underpinned by community by-laws based on: no poaching, no charcoal burning, no overfishing and collective responsibility for sustainable land use and alternative livelihoods (bee keeping, vegetable production/horticulture etc). Community groups are trained in conservation farming and company R is in the early stages of investigating how to access the carbon markets, by being able to manage and measure the impact of positive land uses on carbon levels in the soil and being able to trade carbon credits. Compliance to these agreements is checked on an annual basis in partnership with ZAWA.

Other features of their approach include:

- **Local Depots** provide market access to farmers who can sell on surplus grains
- **Community Service Centres** provide training, provide transfer of commodities into urban markets and ensure that company R is working toward clear community objectives. Company R collects and aggregates agricultural produce (maize, beans, soybeans, rice, groundnuts, and honey) and pays cash to farmers. Farmers who have adhered to their agreements get premium prices, those who not complied get below market prices and those who excelled get premium 'plus plus' prices
- **Manufacturing Hubs**. All produce collated is transported to the manufacturing hubs /agro processing hubs, where produce is processed and packaged under the company brand.

For the purposes of this intervention we will not focus on company R's services (including engaging stakeholders, driving compliance in partnership such as ZAWA) – but on the potential of company N as an investment opportunity.

Currently all manufacturing hubs processing/packaging and value addition to the product is done in the Eastern Region and essentially serves the Eastern Regions of Zambia. However, there is an appetite to scale up production and process produce from across the country. There is currently a plan to start engaging with farming communities in the Western regions of the country, in particular in the Kafue sub-basin in 2014.

Company N would be interested in support from the IFC to help support scaling up their Agro Processing capability. In particular, to support the set up of a new manufacturing hub in potentially in Lusaka or an alternate location.

In the context of the impact of this investment on company N being able to service the Kafue sub-basin, in particular there are several points to highlight:

- A Manufacturing Hub to be constructed, to centralise and scale up agro processing capability
- Company R's Community Service Centre facilities are available to company N on an exclusive basis and this service would include aggregating agricultural produce and transporting to Lusaka.
- Any focus on targeting farmers in the Greater Kafue National Park region, from 2014 would be dependent on key growth strategies and objectives being met by company N in 2013. In terms of developing growth strategies and scaling the business up, company N indicated interest in IFC's Advisory Services to support the process.
- The economic climate around the Greater Kafue National Park is complex in nature. The eastern and southern Game Management Areas are severely encroached and badly affected by negative farming practices and poaching – therefore it has been highlighted that this business opportunity needs the support of partners in the region in order to be a success. This includes working closely with ZAWA, the chiefs, community groups and other businesses working in the area.

  This would need to involve careful land use planning, including a commitment to move away from more traditional cash crops – notably cotton and tobacco (which in this context can encourage negative farming practices by the small holder farmers). This approach could include appropriate agricultural zoning in the GMA's to preclude the growing of cotton and tobacco and zoning in the adjacent open areas by chiefs to ensure that conservation/climate smart agricultural techniques are being practiced in these open areas – providing an additional buffer of support to the GMA's and the National Park.

Key features of the investment include:

- Company N provides access to markets to farmers – responsible for taking inventory into supply chain;
- Company Q is prepared to support this investment, providing company Q packaging to leverage the brand – and access to regional markets;
- Communities in vulnerable areas targeted to work with and terms and conditions agreed with and by-laws set up for compliance;
- The defined community has to agree to comply to by laws, with an annual compliance check by key stakeholders including ZAWA
    - Compliance results in premium prices
    - Non-compliance results in a drop in prices, and
- Community Service Centres – providing extension services and acting as trading centres, typically funded by grants.

3.4.3.2. Company O

Company O is involved in the processing and marketing of traditional nutritious crops, goat meat and free-range chicken. The company trains the farmers on production processes, offers extension services, and buys the produce.

Company O is currently considering the purchase or construction of a processing and canning facility to meet local and international demand and increase revenues. Its training is focused on the point from harvest and post harvest training helping to work like entrepreneurs.

Company O is interested in finding an investor to invest in the company's proposed Agro processing plant, located near Mumbwa able to service local smallholder farmer as well being a central collection point of produce from the Western Province and surrounding region.

It is envisaged that this factory would have three lines:

- Processing vegetables /dried vegetables
- Canning (village chicken, soup)
- Processing starch – in particular cassava

3.4.4. Climate Change Rationale

- Access to markets for rural smallholder farmers
- Compliance to conservation farming techniques, anti-poaching and anti – charcoal programmes Designed to address and mitigate poaching, deforestation and drive the adoption of conservation farming
- Use of market forces to drive people's behaviour and incentivise climate smart agriculture techniques
- Use of agro forestry systems and cover crops can reducing soil erosion, transfer organic inputs to soil microorganisms, increasing levels of soil organic carbon, and increase water holding capacity of soils
- Mitigation co-benefits: carbon is sequestered in perennials and soils above the baseline levels and opportunity for company to realise revenue via the carbon markets.

3.4.5. PPCR Results Framework

These are aligned with how the Soya and Access to Finance interventions align to the PPCR results framework, in particular improving the quality of life for communities most affected by the impacts of climate change and variability.

3.4.6. Investment description

Company N

In 2013 company N's strategic focus will be to consolidate, policies, lessons learnt, legal framework, and market results to demonstrate potential for impact to existing partners.

It is planned that after this phase of work – Company R/company N will begin scaling up services and Agro Processing in 2014. It was discussed that this work aligned with strategy development would benefit from input from IFC's Advisory services to validate strategy development and aligning to any investment decisions.

Company R/company N did not articulate costs required to construct a new manufacturing hub – however they did indicate that there interested in identifying appropriate partner to invest in this venture and also indicated interest in

Its Wild would be interested in the following investment and support from IFC:

- Start up capital to construct the manufacturing hub/agro-processing centre in Lusaka
- Investment and strategy development Advisory support
- Access to international marketing and branding opportunities

Company O

Company O estimated that it would cost $2.5 million to build a three line (vegetable production, starch and canning) processing centre in a location such as Mumbwa. However, further detail of the costs was not provided and assumptions behind this figure would need to be validated.

It would be beneficial to investigate if this proposed investment could be linked with IFC Advisory services to align strategy development, business development and investment opportunities.

Company O would be interested in the following investment and support from IFC:

- Start up capital of approximately $2.3 million to build a three line agro processing factory, located close to smallholder farmers and appropriate roads to transport produce back to urban areas, for example Mumbwa.
- Investment and strategy development Advisory support

3.4.7. Market, financial and technical risks involved

Market Risks

- Appropriate marketing required locally and internationally to generate consistent demand for products, budget required for marketing
- Need to secure reliable, quality source of produce

Financial and Technical risks

- Need to confirm capacity of business to scale up and provide appropriate Advisory support
- Need to understand how transport of goods from Mumbwa to Lusaka, or Western Province to Mumbwa would be organized and paid for.

3.4.8. Financial gaps

Detailed figures required to calculate the viability of the interventions could not be provided.

3.4.9. Challenges/ Critical Success Factors

- Company R does not plan to move any operations into the Kafue National Park area until 2014
- Resource and scalability issues – the interventions of companies N and O could have capacity challenges to scale up Successful Agro Processing intervention may lead to further GMA encroachment as people move into the areas towards economic activity
- Agro processing plans currently are in the Eastern province – difficult to move produce there, a centralised location (say Lusaka) would need to be considered
- Communities engaged need to buy into the concept and be prepared to comply
- Extension Services staff need to be extremely high caliber
- Risk that if goods are linked to corporations who are less concerned about compliance and more concerned about produce – they may undermine the underlying principles

3.4.10. Alternate Investment 1: Company I/Company S – driving transformation in the Zambian oilseed supply chain[45]

The following intervention is an alternate agro-processing option, building on an existing relationship between companies I and S to off take and process soya and sunflower produce for oil.

Executive Summary

Small holder farmers in Zambia have a rare opportunity in soya and sunflower farming. World demand for edible oils and feed cake is growing and commodity prices are high. As a result, processors in Zambia are planning to nearly double crushing capacity. Commercial farmers' reaction to date has been to increase production but a supply shortfall still remains, offering a unique opportunity for smallholder farmers to become important players in the supply chain. Company I, a new processor with over 40% of all capacity, is committed to sourcing a large share of its supply of raw materials from smallholder farmers. This is not only an appealing proposition for farmers because of the guaranteed market, but also because it 1) offers farmers potentially higher returns per hectare than the current staple crop, maize, 2) allows for soil improving crop rotation in the case of soya, and 3) would mean a diversification of crops, thereby reducing risk while offering improved dietary options.

However, there are several challenges in the local supply chain that limit sufficient and efficient product flow from smallholders to the market. First, sourcing is costly due to the fragmented supply base which drives inefficient and high transaction costs in aggregation. Second, the lack of market knowledge and assurance hinders farmers' ability to plan and make good crop choices. Third, access to inputs is unreliable and the quality of public extension services is poor, leading to yields far below international standards. Lastly, the lack of working capital limits purchasing power of aggregators at the time of harvest, which leads to unreliable contract fulfillment and high rates of side selling by farmers for below market prices. Comprehensively addressing these shortcomings will allow company I to achieve commercial success, while at the same time increasing income for farmers and aggregators.

To achieve our vision of success, companies I and S propose a 5-year innovative program that aims to improve the income and resilience of 30,000 smallholder farmers by creating an efficient, fair and reliable oilseed supply chain. This will be achieved by strengthening the capacity of aggregators; facilitating linkages along the chain; ensuring stability of supply, and boosting yield and production.

The innovations that drive the success of the proposed program are 1) the fundamental shift in role of smallholder farmers from peripheral to strategic suppliers of raw material, 2) the pivotal value adding (cost-reducing and market making) role of aggregators, 3) the establishment of a forward contracting model that will incentivize contract fulfillment along the chain, and 4) an enhanced price discovery mechanism by developing Zambian-based futures contracts.

A partnership between companies I and S I will drive the necessary interventions. Company I will play a pro-active role by providing the market and assigning dedicated staff for smallholder origination, as well as allocating cash for investments benefitting the outcome of the program. Company S's role is to facilitate capability building for aggregators that will allow for increased efficiency and reduced transaction cost. Key elements of this are input availability, the ability to form formal market linkages, access to working capital and providing quality extension services. The 5-year program will cost $8m to implement, 50% of which requires funding and the other 50% will be contributed by the partners. The partnership is currently exploring the possibility of expanding the program by involving company K as major aggregator, which would increase its reach of the program to over 100,000 farmers.

Problem Definition

For the processor: In order to capitalize on the market opportunities driven by continued global and local market growth, company I intends to make a significant investment in new capacity in edible oil and feed processing in Zambia. Company I has a successful smallholder farmer sourcing strategy in East Africa that they

[45] Concept submitted by Company S/company I partnership for consideration

are planning to use in Zambia as well. However, Zambia has a supply base of 150,000+ farmers and limited aggregation services, which increases transaction cost. In addition, contract fulfillment is historically unreliable due to the prevalence of side-selling by farmers to cash-rich agents, who show up opportunistically at harvest time. Company I is therefore looking at an aggregation model that would allow company I to realize their smallholder sourcing vision for Zambia in a cost-effective manner. Once such a model is achieved, company I's processing capacity allows them to buy all smallholder volume available to them.

For the producer: Due to poor organization, limited information and fragmentation, smallholder farmers who might benefit from soya and sunflower production lack awareness of the market demand, prices and bargaining power that would allow them to make better choices, have access to the national markets and receive fair prices. In many cases, they also lack the technical expertise to diversify into soya and oilseeds, as well as access to inputs required to do so successfully. As in much of Sub-Sahara Africa, government extension services are patchy and unreliable.

For the aggregator: By aggregating supply, reducing transaction cost and improving production, efficient aggregators will provide critical service in a smallholder supply chain. As evidenced by the USAID-funded PROFIT program as well as Company S's present soya work in Zambia, input dealers and agents have proven to be effective aggregators and extension workers by leveraging the farmer network they established for input distribution. In this model they are capable of providing a complete range of input and output value-adding activities to thereby increase efficiency and lower cost. However, to successfully scale-up this central role, access to short-term trade financing loans as well as broad improvements in the quality of the extension services are of paramount importance.

In order to address these problems and to create a well-functioning and efficient supply chain, companies I and S propose a comprehensive strategy from farm to market that addresses the root causes of the market failures in a sustainable way. This model hinges on the role of aggregators as value-adding middle-market intermediaries in the chain and also binds the ultimate market purchasers – large, stable traders and processors – to the smallholders and their wellbeing. Being successful in achieving this will ultimately lead to benefits for the wider farmer economy as the strengthened position of these intermediaries will allow for replication and reach beyond soya and sunflower.

Background

The Zambian oil & feed value chain: In the oil and feed value chain, economic value is realized when raw materials are commercially processed, making processors the primary market drivers. Zambia has around 10 processors and the increased demand for their products has led to investments that will increase crushing capacity from 150,000MT to over 300,000MT in two years. Established processors, like company H, are increasing their existing capacity. But new players are entering the Zambian market in a big way, like company I who is currently building a new $25m, 120,000MT plant. With a current annual production of up to 140,000 MT, excess capacity will be at least 130,000MT. Competition for crushable materials will be vigorous, stimulating a sellers' market for soya and sunflower.

Although commercial farmers historically supply 80% of all oilseed in Zambia, capacity increases at these farms is expected to only be around 50% in 2012, indicating a significant gap in supply in the short- to medium-term to satisfy demand. This gap, combined with company I's commitment to source from smallholder farmers, offers a significant opportunity for small producers to capture market share. Around 62,000 farmers are currently estimated to grow soya and over 100,000 grow sunflower.[46] Given that most farmers are not organized and geographically dispersed, the most efficient way to source from such a supply base would be through a network of least-cost aggregators.

Soya & sunflower opportunities: In the last decade the Zambian government's agricultural focus has been mostly on maize production as a mitigation strategy for food shortages, providing subsidies and other incentives to make it an attractive choice for farmers. As a result, farmers have abandoned or limited other viable crops, like soya or sunflower, due to the (perceived) attractiveness of maize.

Be able to compete with maize on a local, soya shows continued strong crop economics due to the strength of commodity prices (see table 1 below). And given the continuing strong global commodity prices and the production shortfall in Zambia in the short term, these farm prices are expected to remain high for the next 2-3 years. Once production starts meeting domestic demand prices will begin to return to historical levels, but this is likely to take over three years. During the window of opportunity, farmers will learn to increase productivity

[46] Maco crop forecast survey 2010/2011

and incorporate other value chain efficiencies, and will become profitable soy producers even when prices drop to historical levels.

For sunflower the picture is somewhat different. Although production costs are low and profit per MT higher than in maize, profitability per hectare is currently low. This disconnect is mostly driven by low yields. International benchmarks indicate relatively simple changes in farming practices could double yield. In addition, company I is willing to commit to a sunflower price significantly above the market, of $400/ MT, enabling farmers to make many times more per hectare on sunflower than on maize.

An overview of the economics of these three crops shows the economic value for farmer of the program:

Table 1: Profitability by crop 2010/2011 versus profitability by crop as result of the program

Category	Current Situation			After program interventions		
	Maize	**Soya beans**	**Sunflower**	**Maize**	**Soya Bean**	**Sunflower**
Production cost/ Ha	$ 573	$ 400	$ 140	$ 573	$ 400	$ 300
Yield/ Ha	2.5	1	1	2.5	1.2	2
Production cost per MT	$ 229	$ 400	$ 140	$ 229	$ 333	$ 150
Price per MT	$ 271	$ 630	$ 146	$ 271	$ 630	$ 400
Profit per MT	**$ 42**	**$ 230**	**$ 6**	**$ 42**	**$ 297**	**$ 250**
Revenue per Ha	$ 678	$ 630	$ 146	$ 678	$ 756	$ 800
Profit per Ha	**$ 105**	**$ 230**	**$ 6**	**$ 105**	**$ 356**	**$ 500**

Goal Statement & Objectives

The goal of the program is to improve the income and resilience of 30,000 existing and new smallholder farmers, by creating an efficient and reliable oilseed supply chain that processes an increased share of smallholder volume for fair market prices. This will be achieved by:

- Input supply with embedded extension services to boost yields and production;
- Facilitating linkages between producers, aggregators and farmers;
- Strengthening the capacity of aggregators;
- Stabilizing the supply from smallholder farmers through a forward contracting model; and
- Ensuring access to financial services

To realize this goal, the program will utilize four game-changing approaches:

1. Fundamentally changing supply chain dynamics by ensuring strategic, long-term roles for smallholder producers by integrating them into the oilseed origination setup;
2. Embedding the aggregation role within the input agents/ dealers business model, allowing them to increase efficiency and reduce supply chain costs by leveraging their existing farmer networks;
3. Creating viable, long-term linkages based on contracts that incentivize both production and loyalty; and
4. Allowing for better market function and decision making by enhancing price discovery mechanisms through Zambian based futures contracts.

The partnership model and strategy for implementation

The partnership between companies I and S aims to ensure maximum value realization for all stakeholders. In addition to guaranteeing demand for farmers under fair conditions and providing relevant, up-to-date market date (demand, supply, price, timing), company I intends to assign dedicated resources for smallholder origination and make investments that will benefit farmer access to market.

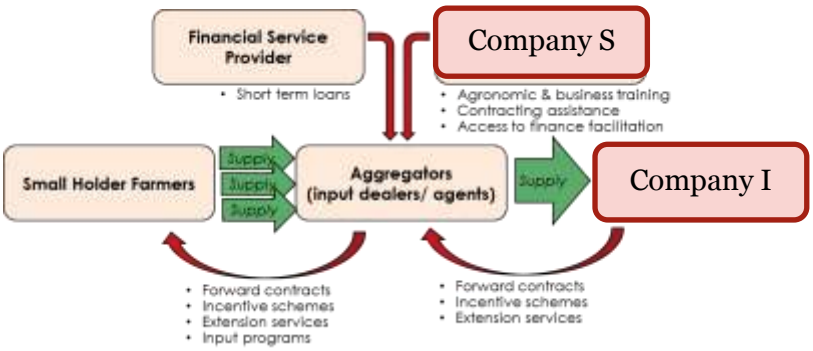
Company S's role is to work with the dealer/agent network to increase throughput capacity, facilitate linkages and improve capabilities. On the input side, Company S will leverage existing relationships with input companies. On the output side, Company S will facilitate the link with company I and work directly with new aggregators to build capabilities if and where needed. Aggregators will in turn train and develop farmers. Since aggregators earn commission on inputs sold and output volumes aggregated, it serves their interests to furnish crop management guidance to their customers. This model allows for maximum leverage of program resources, while providing a highly valued and imbedded service where the public sector falls short. Specific attention will be given to women, who already comprise 10-15% of the dealer network and typically outperform men in

business interactions with other women. Especially when identifying new aggregators, emphasis will be on women's participation.

To ramp up quickly, company S will expand upon its existing soya value chain program. Operational since 2010, this program will have established 50 input dealers/ agents as aggregators by the end of 2012, representing over 4,000 farmers and linking them to the market. The proposed program will increase these numbers to 420 aggregators, covering sunflower as well as soya. Based on an average reach of 70 farmers per aggregators, the program will reach up to 30,000 farmers, who are expected to produce at least 30,000 MT per year by the end of the program.

A critical component of the program will be to bring in a financial service provider with a track record of working with SMEs in Zambia that can unlock working capital for aggregators to allow them to pay farmers on time. Without such provisions, there remains a risk of significant on-the-spot side-selling by farmers, which would threaten company I's supply fulfillment and thereby the success of the program.

Schematic overview of the partnership:



Talks are ongoing to bring company K on board as partner in the program as well. Company K is eager to work with its 100,000 cotton farmers to start growing soya as a rotational crop. However, the company would need assistance in getting the existing cotton extension network trained-up for large scale soya production and are therefore interested in participating in the program. This would not only allow for a significant increase in scope and impact of the program, but it would also enable the program to leverage company K's women's clubs, of which there are currently 416 established in the Eastern Province.

Activities, duration & results

To realize the stated goals and objectives, company S proposes a 5-year program, focusing on the following activities:

1. Facilitate capacity building for dealers/ agents in extension services, input provision, aggregation and commercialization, based on conservation farming practices.
2. Establishing market linkages, in the form of forward contracts based on fair market prices, underpinned with solid business plans and including creative incentives structures to increase productivity, production, profits and loyalty.
3. Bringing in financial services providers, who will provide access to working capital for aggregators. Aggregators will be supported in financial planning and loan management.
4. Setting up a cost-effective and accessible price discovery system, in order to increase ability to plan for farmers, input suppliers and aggregators (building upon existing systems).
5. Monitoring and evaluation, to ensure the program is reaching its intended clients and goals.

The expected outcomes of these activities are:

- Increased productivity, production and profit for smallholder farmer in the program
- 420 dealers/ agents set up as aggregators with access to finance and contractual linkages up and down the chain and access to finance
- Over 85,000 MT of smallholder volume delivered to company I by the end of the program
- High (>80%) contract fulfillment rates
- A transparent and accessible information system

The geographic scope of the program will be on Central (150 aggregators), Northern (100), Eastern (100) and Southern (70) province. Incorporating company K into the program would allow company S to scale up the efforts in Eastern province, as that is where the majority of their cotton farmers are based.

Sustainability of the program
Sustainability can be assessed at two levels: environmental and economic. This program promotes environmental sustainability through its focus on soya, which naturally enhances soil fertility, and the conservation farming approach embedded in the dealer/ agent services, which reduces top soil erosion and improves soil nutrition.

The promise of economic sustainability in this model ties back to the commercial benefits realized by all major stakeholders. If these benefits do not materialize, stakeholders will look for opportunities elsewhere. By establishing successful market linkages, company S will enable actors to mitigate risk and ensure long-term viability of the chain, which will drive increased economic security. In addition, by embedding the model in the value chain at the level of the aggregator, company S creates an opportunity for replication in other value chains, further enhancing the economic sustainability of the program.

Overcoming gender challenges
According to the World Bank women provide 70% of Zambia's agricultural labor[47]. Despite the important role women play, traditional attitudes have precluded them from significantly benefiting from agricultural programs and from playing a greater role in their own economic and social development. Typically, the same cultural restrictions apply to women's participation in SMEs like aggregators. However, with targeted interventions a different reality can be created. For instance Company S' current soya program strategy of leveraging company K's Women's Clubs is showing it is an effective way of delivering interventions benefitting women directly.

This program is being designed from the outset to encourage and support the full participation of women in all program activities and will emphasize approaches that accrue benefits to women. Targets are to work with 20% women-led aggregators while the farmer base linked to the aggregators should contain at least 30% women-led households. To jumpstart this effort the Company S's existing activities with women will be leveraged. If company K joins the partnership, their blue print for women's clubs can be used to reach an even larger number of women-led households.

Budget
The total proposed estimated cost for this intervention is US$8 million over the life span of the program, of which 50% (US$ 4 million) will be matched by the program partners - company I, company S and possibly company K – either in cash or in-kind. The program will also try to leverage resources of ongoing programs related to this, for instance through existing activities in the soya program sponsored BMGF

3.4.11. Alternate Investment

2: Company T/Company S – driving transformation in the Zambian Honey supply chain[48]

Of Zambia's area, about 66% of land surface area is enveloped by miombo woodlands and forests. This vast miombo woodlands and forests dominated by *Brachystegia, Julbernardia* and *Isoberlinia,* which are preferred nectar sources for bees, entails opportunities for apiculture activities. The strong link between forests and apiculture generate opportunities for promoting beekeeping as an incentive for eco-friendly sustainable forest management besides improving lives and local economies. In Zambia, it is estimated that bee keeping and honey hunting improve diets for an estimated 250,000 farmers and are an important source of income for 20,000 rural households in Zambia[1]. Bee keeping activities intensifies during the time when labor demands for agriculture are low and as a result they provide an alternative form of employment for rural people. In Zambia, apicultural activities are concentrated in the Northwestern province which accounts for about 70% of beekeepers in Zambia and apiculture activities in this region are estimated to be the third largest employer in some districts of the Northwestern province.

Apiculture farmers, that mostly include Bee keepers who are also agriculture farmers increase their total annual household income by approximately US$100– US$400 by selling honey and beeswax. For Honey alone, exports from honey produced in the Northwestern province have once reached over 400 metric tons. In this region,

[47] Source: USAID/FSRP 2011
[48] Concept submitted by company S/company T partnership for consideration

about 75% of the population lives on less than a dollar a day and honey sales may account for 25% of total annual income[1]. The apiculture industry in this region has also created self-employment for informal traders of bee-products as well as formal employment in registered companies.

However, the success of the apiculture industry in this region and Zambia as a whole has been attained with massive challenges; and if mitigated upon can result into preserved natural environments and more than doubling the current productions in honey and other bee products. In general, there is an increasing demand for African Honey globally and locally however both local and export demands are not sufficiently met due to the highly erratic supply. The supply is generally affected by inefficient production and poor processing and handling of honey, as well as lack of collaboration among beekeepers for processing and marketing. This is compounded by low returns from beekeeping, Poor apiary husbandry, pests and poor harvesting methods and quality control challenges among many factors.

Therefore, to have a sustainable and profitable apiculture industry in the Northwestern and Western provinces of Zambia, company S and company T, a private Bee products processing company proposes a 5-year novel program that aims to improve the income and resilience of 10,000 small holder farmers by creating an efficient, fair and reliable bee products supply chain. This partnership envisions to strengthen the capacity of bee keepers (individuals and groups), enhance eco-friendly and good apicultural practices thereby preserving local eco-systems and environment, facilitate linkages along the Bee products value chain, ensure stability of supply and heighten yields and production volumes and capacities.

Through this proposed mechanism, the partnership is of the view that there will be a paradigm shift in the way bee keepers view themselves, not as peripheral players in the value chain but as key strategic suppliers of raw material. A partnership between company S and company T will drive the necessary interventions. Forest Fruits will play a pro-active role by providing the market and assigning dedicated staff for bee keepers (individuals and groups) origination and allocate investments. Company S's role will be to facilitate capability building for bee keepers and groups that will allow for increased efficiency and reduced transaction cost. Key elements of this will be input availability, the ability to operationalise formal market linkages, access to working capital and providing quality extension services. The proposed 5-year program will cost $3m to implement, with the partners contributing 50% through investments and in kind contribution. We are looking for funding for the other 50% in order to provide the necessary capacity building assistance mentioned above.

Company T is the biggest bee products processor in Zambia and is committed to improving rural livelihoods by developing business in rural areas of Zambia. As such, it works with over 6,000 traditional beekeepers living in remote forests near the source of the mighty Zambezi River in north western Zambia through an out growers system that includes training and extension services. The major product is honey, branded as product A that is distributed locally to all major retail supermarkets and grocery stores and is exported to the EU and southern Africa sub region.

In the context of these projects – the potential projects in the Western provinces (Barotse sub-basin is of particular interest).

3.4.12. Alternate Investment

3: Company U

Company U is an agro-processing firm, investigating investment opportunities in Zambia. The potential investment consists of two businesses.

1. Farm Produce (100 hectare, out grower scheme)
2. Pulping unit and export

The plan is that the farm produces (fruit produce) stock for the pulping unit- with a view of producing 6 – 10 tonnes per hour. The proposed model for the farm is that the land will be titled under the company, and farmed by out growers (small holder farmers). The company will provide inputs and provide support on water and land management. The out growers would have a target driven model to work towards, to encourage increased productivity.

The feasibility study is underway – and assuming that conditions are proven to be suitable for this investment in Zambia, company U would be interested in talking to the IFC about co-investing in the initial capital outlay. They are also interested in building the capacity of the farms and pulping plant to be able to realise economies of scale. If produce can be produced at the right quality and price, it is more likely to succeed when entering the international market.

3.5. Game Management/Wildlife based land use and Tourism Investment

Natural Capital is a significant resource in the context of Zambia. National Game Parks and wildlife are a form of natural wealth, with the potential to drive economic growth with Zambia.

National Game parks in Zambia are held under the stewardship of Zambian Wildlife Authority (ZAWA) and all game is legally property of the State under the custodianship of ZAWA. ZAWA are not centrally funded and are dependent on licences (high value hunting licences, park fees, fishing etc for revenue). This institutional structure is a structural weakness for ZAWA by making it incentivised to maximise income from hunting, rather than focusing on wildlife management. If ZAWA was funded centrally or enabled to raise revenues via other models, there could be an opportunity for them to take different approaches to regulating game management.

Zambia National Parks are determined by the significance of the areas (Zambia National Park and Wildlife Policy – Draft), and the following criteria:

- Possess nationally significant natural or cultural resources
- Be a suitable and feasible part of the systems
- Be appropriate for direct management as a National Park instead of alternative protection by other land administering agencies or the private sector

Under the Zambia Wildlife Act No 12 of 1998, 'buffer zones' on the outside of the National Parks are provided for in Game Management Areas (GMA's). The Act also provides for *"participation of Local Communities and the Private Sector in ZAWA's CBNRM (Community Based Natural Resource Management) – to manage and develop National Parks*."

Natural resources are a key consideration to the PPCR programme, with a view to improve the "*management of natural resources in the face of climate change in a commercially viable manner*"[49] . In the context of this discussion, we refer to "natural capital" in the context of National Game Parks – using Kafue National Park (KNP) as an example in terms of challenges faced and potential interventions. The interventions considered in this context are not 'traditional' climate change adaption projects. They are reviewed here to assess whether potentially these investments could have positive results in terms of vulnerable communities, being able to have more adaptive responses available to them in the face of climate change.

Zambia is rich in natural resources/natural capital but has not managed to realise this potential in a manner that is sustainable and equitable. As discussed in this report it is threatened by the dual threat of Poaching and Deforestation which is damaging bio-diversity in National Game Parks. In the context of KNP we consider how the IFC could support the development of an enabling investment climate to encourage commercial organisations to invest in the area in a manner that is sustainable and beneficial to the local communities. There may be opportunity for some of these investments to be facilitated via the PPCR fund or by other funding mechanisms.

On average – based on current land usage, populations in GMA's in Zambia have a welfare status that is on average 30% lower than that of average rural populations. [50] This section considers how wildlife land use could be leveraged to reduce the vulnerability of GMA populations and encourage positive land use in partnership with private sector investors.

The significance of wildlife land use in the PPCR context is that it has the potential to enable "*wildlife-based land uses to provide consistent returns in the variable rainfall regimes that characterize much of the savanna biome*"[51] .

This potential is illustrated in Namibia, where "*16-26 million kilograms of game meat are produced annually on private wildlife ranches*"[52]. That 96-97% of the game meat remains within the country gives an indication

[49] PPCR 8SPCR – p97
[50] Kafue National Park, General Management Plan 2011 – 2020.
[51] Potential Solutions to illegal hunting, bushmeat trade & associated challenges, p44. Lindsey et al

of the scale of game meat demand in southern Africa. Wildlife-based land uses on communal land has also reported success with "*at least 315,000 kg of game meat (sic) produced in Namibian conservancies in 2010, resulting in significant quantities accruing to participating households*".

For the purpose of this report, we consider non-consumptive and consumptive tourism and wildlife based land/game ranching use as interdependent interventions that should be able to be implemented to support both the effective management of game and natural capital within the game park, but also to drive a strong and robust tourism sector.

1. A Tourism intervention, designed to catalyse economic activity in the area, that:
    a. Provides a stable economic unit which provides opportunity for local/community business development – spin off tourism, supplier businesses
    b. Brings services which will be used by the community
    c. Provides regional development through investment
    d. Provides alternative livelihoods
    e. Attracts further investment into the area

2. Wildlife land use intervention that:
    a. Is able to leverage a community/conservancy model in a commercially viable manner for the private sector investor and to realise revenues for the community
    b. Reduces poaching pressure and provides alternative livelihoods
    c. Provides opportunity for local community to develop public private partnership with investors
    d. Protection of biodiversity due to effective management of game
    e. Able to take advantage of urban market for bush meat in a legal and sustainable manner

This is dependent on effective land use planning, as appropriate zoning would be implemented to enable non-consumptive, consumptive tourism and game ranching to work as mutually supportive interventions without causing conflict over land use.

Currently, there is inadequate financing for the management of wildlife resources, and there is a need for investment in the form of **management**, to make sure the wildlife areas are secure from poaching. A multipronged approach is required to protect wildlife resources.

These approaches include enhanced law enforcement, including anti snaring/rescue teams, a proactive, practical approach to resolving human/wildlife conflict and preventing negative attitudes being developed in local communities and the development of a robust tourism industry so that local communities can get benefits from wildlife.

In order to generate the economic activity required to build a photo/non-consumptive tourist industry and manage wildlife (in particular re-stocking of game), consumptive tourism/safari hunting is key. Unlike non-consumptive tourism, safari hunting provides an institutionalised revenue stream into Game Management Areas, and provides additional law enforcement activities. However, currently this model is institutionally structured to result in problematic wildlife management because:

- ZAWA is incentivised to maximise income from hunting, as their revenue stream is focused on licence revenues;
- Hunting operators are incentivised to extract and not invest as the leases are too short; and
- Communities are incentivised to extract (especially poaching) because they gain little from ZAWA.

If wildlife user rights were devolved to private investors or communities – who could lease wildlife and land use rights to private sector players, then the key players could be incentivised to a much more productive approach to wildlife investment and long term investment. A key consideration for an institutional framework review is

[52]Potential Solutions to illegal hunting, bushmeat trade & associated challenges, p44. Lindsey et al

that game licences and fees paid to ZAWA are in effect an additional tax, not there for livestock or other land uses – and the net effect is to discourage business interest in managing wildlife.

Another key challenge, is that ZAWA is not centrally funded - which results in a focus on extracting revenues from the GMA's, which promotes over harvesting and takes income which should go to communities. This results in wildlife disappearing in part due to loss of habitat but also due to illegal poaching, which in turn leads to ZAWA's revenue falling reducing its ability to protect wildlife and further reductions in wildlife. In terms of the institutional framework review it needs to be considered how ZAWA is able to gain central funding, to enable it to take a more hands-off regulatory role rather than the operational role it has currently. With the correct legal framework, wildlife populations would increase significantly, and tax revenues for the government would increase, and could form some of the funding for ZAWA[53]. It would also provide significant opportunity for innovative private – community partnerships for wildlife management and land use.

3.5.1. Current challenges Faced

3.5.1.1. Existing conservation challenges

There have been numerous studies and discussions in recent years including – '*Intervention Logic for Successful Protected Area Management and Economic Development (Zambia)*, Richard Jeffery, *Kafue National Park General Management Plan*, *Kafue National Park Business Plan*, '*Natural Resources Consultative Forum Observations on the Safari Hunting Industry in Zambia*' – which have identified recurring themes on the conservation challenges faced by the Kafue National Park, which is a category B National Park that faces severe challenges to maintain game stock and biodiversity.

The GMA's are being encroached upon and over settled, at a rapid rate with increased migration from the Southern provinces being observed. The GMA populations around Kafue National Park are estimated to be 200,000 (KNP Forum, 15th October 2012, ZAWA presentation) and growing. These communities live predominately on a rural subsistence economy, using damaging farming practices, and there are concerns that this encroachment will overspill into the Kafue National Park. This is a particular challenge on the Eastern and Southern GMA's adjoining the Kafue National Park.

Whilst communities in the GMA's are institutionally intended to benefit from the natural capital in the National Parks, by receiving 50% of hunting licences and 20% of concessions – there are constraints which result in communities not realising full benefit:

- Zawa is underfunded which can lead to delays disbursing funds to communities[54]
- Communities not afforded the opportunity or capacity building activities to participate meaning fully in resource management activities – including revenue raising

Due to encroachment, communities themselves are also experiencing increasing fragmentation as new communities move into the GMA's, adding an additional level of complexity when considering how community revenue benefits are realised.

There are increasing signs of the biodiversity of the area being negatively impacted, with increasing levels of deforestation and evidence of declining wildlife stock. Poaching is on the increase – in particular elephant poaching, in over settled areas and the human/game conflict is on the increase as the larger populations in the GMA's attempt to make a living off the land. Poaching provides communities with an additional revenue stream, and the combination of rising local economies – in part driven by Decentralisation and urban (Lusaka, Livingstone and Copper belt) demand for bush meat is creating a significant market for (illegal) bush meat.

[53] Peter Lindsey (Personal communication)
[54] Natural Resources Consultative Forum Observations on the Safari Hunting Industry in Zambia

Indeed, the National Decentralisation plans present a risk to the GMA's unless well managed and planned. Several new districts are being formed in the locality - these districts will attract Government of Zambia supported economies and income. There is a risk that this could result in additional migration into the GMA areas and new urban communities will push up demand for bush meat further.

Law enforcement challenges, in particular low levels of manpower, prevent effective patrolling of the park. Currently there are 191 ZAWA scouts with only 129 on active duty. ZAWA estimate that minimum number required is 449. This challenge is further compounded by poor infrastructure, including access roads within the park. The limited and problematic road access results in a lower level of accessibility by the scouts to track down poachers. These challenges combined are resulting in the depletion of GMA's and significant risk that the National Park is at risk of being encroached and depleted.

3.5.1.2. Climate change challenges

The Barotse Kafue sub-basin has been identified by the PPCR programme, as one the most vulnerable areas –or "most exposed to climate extremes" in Zambia.[55] In the context of the Kafue sub-basin (and within the Kafue National Park) – projected annual temperature increases 3- 6° by 2100, which is likely to affect "*soil moisture and seasonal patterns of rainfall, thereby affecting agriculture and biodiversity*"[56]

Precipitation variability is projected to increase –with the October to December months becoming drier and the December to May, being subject to high incidences of heavy rain events. The combination of the changes in temperature and precipitation variability is predicted to result in an increase of extreme weather events such as extended drought or flooding.

Due to the reasons discussed in the conservation challenges section, communities in the Kafue National Park are extremely vulnerable to climate change /variability and extreme weather events. The GMA populations rely heavily on subsistence farming, typically mono-crop (maize), which is at risk of climate –induced crop failure.

The wide spread deforestation and charcoal burning enterprises, contribute to the depletion and erosion of soil – resulting in communities having to supplement agriculture activities (due to poor yields) including bush meat poaching and charcoal burning. The depletion of the soil can be further exacerbated heavy rains, as soils are washed away. If soils are washed into local waterways, creating silt which has a negative impact on the water quality.

An overall impact to the communities of these climate challenges is increased threat to food security.

3.5.1.3. Market & Regulatory challenges

There are limited alternative livelihoods available to communities in the GMA's, with a key challenge preventing the development of new opportunities being access to market challenges. The communities /Community Resource Boards' (CRB) do receive some support, but this is limited to what can be provided by Game Rangers International (GRI), The Nature Conservancy (TNC) and the World Wildlife Fund (WWF) – who all have limited resources.

There are low levels of investment from the private sector and Kafue National Park generating relatively low levels of income, from the businesses that are in place. The regulations in place are perceived by stakeholders to result in a difficult investment climate – issues include:

- Land remains under the ownership of the State, under the custodianship of ZAWA. Land Lease available in the National Park Areas, via tender from ZAWA. Tourist site tenures as awarded by ZAWA are typically short to medium term in nature, with concessions being offered on average for 10 years only, although this can be extended to 30 years depending on the nature of the investment.[57]

[55] Strategic Program for Climate Resilience in Zambia (p25)
[56] Strategic Program for Climate Resilience in Zambia (p29)
[57] Example Zawa bid for Tourism Concessions " Tender for Tourism Sites in the Greater Livingstone Tourism Area" August 2012, p14.

- Management of the GMA's is weak. In part due to ZAWA having multiple demands being placed upon it with limited resources, as it is not centrally funded and depends heavily on hunting income – which yield limited returns for the communities.

- GMA governance via Community Resource Boards and Village Action groups have not had their capacity sufficiently developed to deliver effective governance services.

- The licensing and fee structures can be complex, resulting in hidden investment costs.

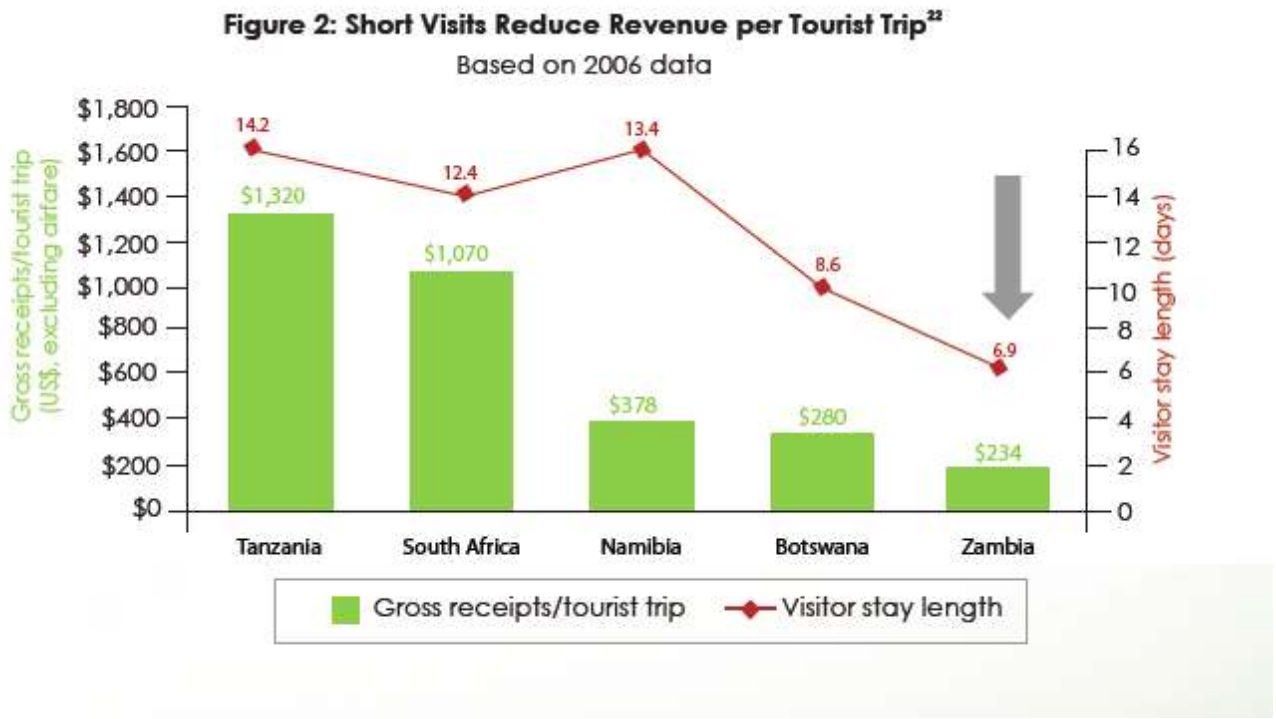
- All wild life ownership rights are held by the state, which restricts the ability of the private sector and communities to be able commercialise game.

- The current regulation and licence structure does not lend itself for effective game management (and is resulting in declining game stock) – as ZAWA is overly dependent on hunting income, hunting operators do not have strong incentives to prevent them from overhunting and communities are more likely to poach as they receive so little from ZAWA in terms of revenue. Hunting concessions are constructed in such a manner to encourage depletion of game, rather than managing game, due to a "*quota performance measure that requires hunting companies to pay for their full quota in advance without adequate sensitivity to the availability and status of the animals in given area*"[58]

- Poor marketing for Zambian Tourism and Kafue National Park in general, is a barrier to both tourism development and private sector investment. The Kafue National Park General Management Plan 2011 – 2020 has also noted that there is "*insufficient co-ordination of activities between public and private sector agencies concerned directly or indirectly with KNP and GMAs*". In our interview with local hotels, this point was re-iterated in every interview.

Tourism is a significant source of income for Zambia and has the potential to deliver further economic growth to the country – with Zambia taking a small share of the regional and global tourism markets. It is estimated in the DFID/ Government of Zambia report "What would it take for Zambia's Tourism Industry to Achieve its Potential" that "Zambia … (sic)… receives less than 1 percent of global visitor arrivals and smaller proportion of global visitor revenues. In 2008, it received 4.4 percent of all visitors to SADC". Tourists also stay a shorter amount of time in Zambia – often as part of a region wide safari, which reduces again the income raised in the country.

[58] Natural Resource Consultative Forum Observations on the Safari Hunting Industry in Zambia, p3.



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3.5.2. Impact of Challenges

The consequence of these challenges on natural resources in the National Game Parks and surrounding GMA's includes:

- Increased levels of harmful agricultural practices leading to depletion of pristine areas
- The depletion rather than management of game
- Depleted areas facing higher level of food security issues – leading to increased levels of charcoal burning and poaching of bush meat
- Deforestation and poaching negatively impacting game populations, which negatively impacts on the tourism market – reducing the potential for alternative livelihoods
- Poaching reducing wildlife stock and biodiversity within the national game park
- Lack of international marketing of Zambian tourism. An average 80% of tourists in Livingstone are on short stop tours from the region rather than a trip to Zambia (Personal communication, stakeholder F, GM Southern Sun – see Appendix 1.7) [IFC notes that the appendix number needs adjustment.]
- Lack of interest from investors who perceive regulatory challenges and lack of market demand to be key inhibitors to investing in Tourism (including the Kafue National Park - See Appendix 1.7) [IFC notes that the appendix number needs adjustment.]
- Increase vulnerability of local communities to climate variability and climate change
- Reduced game results in less tourist interest in the game park.

[59] What would it take for Zambia's Tourism Industry to achieve its potential? July 2011, UKAID.

3.5.3. Intervention Description

"*Due to the perceived issues with the investment climate and the lack of development of the tourism sector and tourism-related infrastructure, investors in developing tourism industries and large integrated resorts in developing countries are in high demand. Countries offering the most viable investments with the most favourable operating conditions and the best, easiest terms are most likely to secure investments*". [60]

We propose that the IFC's support this intervention by providing Advisory Services to support the development of an investment climate that is conducive to supporting both a strong tourism industry and effective wildlife management. Further, to generate greater investment interest the regulatory challenges facing both the tourism and game industries today must be addressed.

The Kafue National Park Business Plan developed in 2010, estimated that the development of the tourism sector in the park via Concessions and Value-Added tourism based business activities would "*more than double the Park's current capacity to 1,200 tourist beds with a revenue projection of over US$7 million*". However, it is clear from the start of the report the appropriate business enabling factors need to be in place in order for this vision to become a reality: *"Other challenges to ensuring success in implementing this Business Plan include: achieving a reduction in illegal hunting; increasing the wildlife stocking rate in the Park; developing the Park's access and management infrastructures as envisaged; and, creating enabling economic, political and social environments conducive to tourism-based business investment."*

The KNP Business plan proposed a Public Private Partnership (PPP) structure to concession out blocks of the national park (known as Joint Management Concessions - JMC'), however the project to market these concessions was unsuccessful and there was no investment interest generated.

Discussions with ZAWA as part of this study noted that the lack of investment interest is perceived to be due to:

- Lack of KNP readiness for the investment
- Infrastructure constraints
- Questions about how appropriate the broker was to find investment opportunities
- Policy changes required to allow for investment
- Investment potential was not packaged in a manner that made them attractive investments[61]

We propose that due to the challenges of attracting the right investment into national parks, and Kafue National Park in particular seen in the last few years that a project that focuses on the institutional framework and regulation required to both manage biodiversity / wildlife and promote a vibrant tourism industry would be a more valuable intervention, than recommending a particular investment opportunity. The IFC's investment methodology 'Investment Generation Approach'[62] , which is typically used to identify and secure anchor investments in tourism.

It could be leveraged in the context of Kafue National Park to do the following, in the methodology's six stage approach:

1. Scoping and Diagnostic : Confirm the potential investment opportunities
2. Opportunity Creation: Selecting and securing the sites, scoping social, environment/ climate resilience and economic impacts, stakeholder buy-in, understanding barriers to investment

[60] Facilitating Large-Scale Tourism Resorts in Mozambique The Tourism Investment Generation Approach, p25 IFC, World Bank Group
[61] Meeting with ZAWA, 30th October 2012
[62] Facilitating Large-Scale Tourism Resorts in Mozambique, The Tourism Investment Generation Approach, IFC

3. Outreach: Design investment promotion strategy, marketing materials, site level sensitization, designing investment climate reforms, promoting investments, selecting investment procurement method
4. Procurement: identifying and procuring the appropriate investor
5. Investment: sealing the deal with the investor
6. Post Investment : additional support to investor and supporting integration into the local area

In addition to the six stages detailed, there are three cross cutting work streams which underpin the methodology:

1. **Stakeholder dialogue, involves** building the capacity of the counterpart institutions and coordinating with partners and other interested parties at national, provincial and local levels.

2. **Investor mobilisation** constitutes the core process of the approach: investor identification, investment outreach, and conclusion of deals.

3. **Investment climate reform**, entails identifying and improving regulatory and other constraints to investment, specifically those needed to conclude the envisioned deals.[63]

We propose that this approach to be able to remove the investment barriers identified and to be able to develop related 'anchor investments' to catalyse further investment in the area, and support the existing work in Zambia to reform both tourism and wildlife management.

Key to the success of these from a PPCR perspective is that the vulnerable communities must be able to materially benefit from any investments facilitated via this approach, in particular with regard to:

- Alternative livelihoods
- Food security
- Positive land use
- Biodiversity and eco-system protection

Potential Anchor Investments to consider

1. Wildlife land use conservancy, with a private sector investor and shareholding for the community.
2. Larger scale safari hotel, designed to drive economic growth in the area.

3.5.4. Climate Change Rationale

Multiple studies over the last decade including the KNP Business Plan , ' Financial and Economic Analysis of the Costs and Benefits of Managing the Protected Area Estate', have indicated the potential positive economic impact of effective wildlife management and scaling up tourism in Zambia, in particular can realise positive community benefits including:

- providing alternative and additional livelihoods for the rural poor
- Food security - either via game produced or income generated through tourism
- positive economic catalyst into the locality – generating additional business opportunities for local communities (for example, spin off tourism activities and suppliers)
- Positive land usage and demonstration of good wildlife management
- Increased & diversified livelihoods
- Positive land use – which is also commercially more lucrative for communities, in particular if the communities have a real stake in the wildlife based land use
- Reduced vulnerability to the negative impacts of climate change, due to diversified livelihoods and retention of woodlands (carbon sequestration).

[63] Facilitating Large-Scale Tourism Resorts in Mozambique, The Tourism Investment Generation Approach

A key benefit is the ability for communities to be able to generate a higher and more sustainable revenue stream than they are currently - from tourism and wildlife based land use.

3.5.5. PPCR Results Framework

PPCR Result	Indicator	Does the Tourist intervention comply with the Framework?
A1. Increased resilience of household, communities, business sectors and society to climate variability and climate change	Indicator 1. Change in percentage of households (in areas at risk) whose livelihoods have improved	• If community is earning income from leasing wildlife and land use rights – increased revenue can be realized • Increased food security, where there are game ranches in which communities have a shareholding. • Improved salaries/income generated working at the hotel • Conservancies (Namibian style) opportunities to raise revenue for communities, improve biodiversity and strengthen grassroots democracy and governance
	Indicator 2. Change in damage/loss (4) from extreme climate event in areas at risk	• Diversified livelihoods means that communities less vulnerable than when dependent on subsistence farming only • Game more resilient to extreme weather events, so where land use is allocated to game – there is less vulnerability to climate variability • Retention of woodlands (and thus carbon sequestration) inherent in wildlife based land uses • Wildlife based land use is a means of Southern African countries adapting to reduced rainfall regimes predicted to arise from climate change
	Indicator 3: Numbers of people supported by the PPCR to cope with effects of climate change	• Estimated Population of 200,000 in the Greater Kafue National Park GMA's
	Percentage of people with year round access to reliable waters supply	• Does not apply to this intervention
A2. Strengthened	Indicator 1: Degree of	• See critical success factors.

climate responsive development planning	integration of climate change in national planning	Underpinning this intervention is the assumption that IFC can impact on policy and land use planning • Newly proposed legislation to manage GMA's or similar could be climate responsive • Tourism investments can be based on climate responsive infrastructure and resource management criteria which would need to be incorporated into national planning for resource management.
B1. Strengthened adaptive capacities	Indicator 1: Vulnerable households, communities and business use improved tools, instruments, strategies to respond to Climate Variability and Climate Change	• Move away from dependence on subsistence agriculture and risks associated with climate variability and climate change • Non destructive land use (photo tourism), game drives providing de-facto poaching patrols, which protect the natural capital, bio-diversity and eco-systems.
B2. Improved institutional frame work in place	Evidence of strengthened government capacity and coordination mechanism to mainstream climate resilience	• See section on Critical Success Factors. Regulatory changes identified include the strengthening of participatory approach of the Community-Based Natural Resources Management groups (CRB's and Village Action groups) and their ability to deliver effective natural capital governance in the GMA areas. • Ability to leverage holistic land management practices to address desertification issues and empower communities
Use of climate information in decision making routinely applied	Indicator: X number of climate information products/services used in Y number of climate sensitive sectors	• Potential to use the mobile platform to share information on poachers, fires and other emergencies/incidents within the National Park.
B4. Improved sector planning and regulation for climate	Indicator : X number of climate sensitive sectors adopted regulatory reforms that incorporate	• Legislation and regulation changes made to create an enabling environment for tourism sector could be defined to incorporate

resilience.	climate resilience	climate resilience factors – such as a requirement for private investors to support local /community tourism related investments
B5. Climate responsive investments approaches identified and implemented	Leverage ratio of PPCR funding against public and private investments in climate sensitive sectors	• Private sector tourism investment used to attract additional private sector investment into the area. Providing alternate revenue earning options for local community. • Potential to set up private – community investment vehicles into tourism and game management investments. • IFC anchor investments in this context developed to incorporate climate resilience criteria, when being developed and marketed as investable opportunities
	Indicator 2: Climate responsive financial instruments/investment models developed and tested	• The IFC's 'Investment Generation Approach' methodology adapted to incorporate climate resilience criteria.

3.5.6. Investment description

One of the defined outcomes of the Investment Climate project would be identify and market appropriate market opportunities.

3.5.7. Economic Analysis

Anchor Tourism Investment

If this support was able to realize a significant tourism investment (in the form of one large, or multiple smaller investments), then this would provide an opportunity to increase the revenues for ZAWA and the initiative for Community-Based Natural Resource Management (CBNRM) via Community Resource Boards (CRBs) to be able to realize more revenue via park fees, and associated leisure tourism licenses (for example fishing) if the Itezhi Tezhi site was realised as a Tourist investment.

As a 'Category B' national park – international tourists are charged $15 per person per day, assuming occupancy of 50% and two guests per bed: 365 nights multiplied by 50 beds, multiplied by two equates to 36,500 heads per annum. Multiplying the individual people by the park fee $15 gives ZAWA and local CRB's an annual income of $547,500 – before any associated licenses fees or wages earned by being employed by the hotel or providing spin off tourism services. However, if Kafue National Park was upgraded to a 'Category A' national park – park fees charged could be increased at least to the $25 (or $30 for self drives) charged currently for South Luangwa. This is of importance because 35% this revenue stream is re-invested into the community via the Community Resources Boards (CRB's) – and can be used for a variety of purposes, including school/clinic constructions, education sponsorship, infrastructure, empowerment of local communities and improving farming systems etc or potentially could be used as part of a match fund with a private investor to invest in associated spin off community based tourism activities.

In addition to a proportion of park fees, and potential licence fees being re-invested into the community, there would also be a positive economic impact on the local economy – which could be significant in reducing vulnerability to climate variability or extreme weather events.

The Kafue National Park business plan estimates that over the long term, "non-consumptive wildlife –based business activities (mainly tourism) offer the higher income earning potential in Protected Areas, and for KNP this translates to a land use value of US$17.3/ha which is the highest return possible from the Park under the given conditions and permitted land-uses, far exceeding other land uses"[64].

In addition to employment opportunities for local GMA communities, there are further enhancements of opportunities in the form of:

- Supplies to the hotel
- Spin off tourism businesses (e.g. game drives, community camping, arts and crafts)

These figures are considered in comparison to current estimated earnings on a 5 hectare plot in a GMA, providing an annual income of 3,250,000 ($650). This assumes 50 bags of maize being produced and the sold to the FRA at 65,000 ZMK per bag. Indirect benefits can also be material, the investment could enable peripheral opportunities: hotel suppliers spin off services, additional investments for the private sector, which could potentially include additional hotels, commercial farmers etc.

Anchor wildlife based use Investment

In order to realise climate change adaptation benefits, this investment will have to be structured in such a way that it benefits local communities. If wildlife user rights were devolved to the communities, enabling them to leverage these rights in partnership with a private investor, it is possible that Zambia could start to realise the scale of returns seen in Namibia – with 16 -26 million kilograms of game meat being produced a year, on private wildlife ranches and Wildlife-based land uses on communal land has also reporting success.

There is currently a longer study being completed in Zambia *"An assessment of the scale, benefits, potential and constraints associated with the wildlife ranching industry in Zambia"*[65], being funded by the Wildlife Producers Association Zambia. This study is unpublished and is not due to complete until March, however preliminary findings indicate investment opportunity for the private sector, when working in a long term private community partnership – assuming that that the community are legally empowered to realise revenues from this investment.

However, as Pr. Brian Child has pointed out in his research, it is unlikely that wildlife ranching is able to become economically viable without a trophy hunting component being introduced to enable the re-stocking and management of game. In the context of the PPCR programme, this provides a challenge as trophy hunting does not adhere to the PPCR framework – however is a critical dependency to this intervention. It may be that the IFC may want to consider that associated trophy hunting component be funded via a private equity or alternate financing stream – rather than the PPCR funds. The Zambia market for this revenue stream has recently become more attractive due to the ban on hunting implemented in Botswana in 2012.[66]

If we use Greater Kafue National Park as an example – with a particular focus on the GMA's as GMA communities tend to be very vulnerable, particularly in over settled or depleted GMA's. An immediate challenge to introducing a wildlife land use intervention in this context is that on GMA's is that wildlife game ranching is prohibited in GMA's with the hunting concession owner having the exclusive rights to hunt game in this area. Another challenge is that the hunting concessions for (non-depleted) GMA's is already in progress and hunting concessioners will be issued a ten year licence. However, there is an opportunity for IFC to approach concessionaires who understand the importance of effective land use management to ascertain whether they would be interested in investing in a joint private- community model.

[64] Richard Jeffery, Intervention Logic for Successful Protected Area Management and Economic Development, March 2012
[65] Lindsey et all
[66] February 2013, hunting bloc tenders cancelled and ban on hunting implemented, for 2013 in Zambia.

Depleted GMA's are not currently being tendered as concessions (November 2012), and as they are badly impacted by encroachment they would benefit significantly from the successful implementation of the proposed intervention. During our meeting with ZAWA[67], it was discussed whether there was any potential for depleted GMA's to be re designated to allow for game ranching within the GMA, particularly if the game ranching opportunity was structured in such a way to benefit the community. However, it is expected that Depleted GMA's will be tendered early January 2013, which could preclude inclusion into this programme due to timing issues. Another option is to invest in a wildlife based land use project in the Open Areas adjacent to the GMA is in effect providing an additional buffer zone to both the GMA's and National Game Park.

3.5.8. Operating Requirements

Operating requirements are dependent on having an appropriate institutional framework in place.

3.5.9. Market, financial and technical risks involved

- Need to address low market demand for Zambian tourism
- Institutional framework and investment climate needs to be addressed
- Licence to manage game – is in effect an additional tax on wildlife that livestock owners do not face
- Current ZAWA and CRB arrangements are subject to challenge

3.5.10. Challenges/ Critical Success Factors

There has been significant work investigating potential in the Kafue National Park. However no investments have been made to date. The broker engaged to secure investment for the public private partnerships – to invest in the Joint Management Concessions was not able to identify and negotiate a deal, and the Work Bank withdrew a $160 million investment for the "Greater Kafue Economic Development Project (GKED)" in 2011. Reasons for this have been variously cited as, lack of readiness by the Kafue National Park, Infrastructure constraints, the appropriateness of the broker selected, policy changes required and the investment potential was not packaged in a manner that made them attractive investments.[68]

The Implementation Complete and Results report for the "*Support to the Implementation of the Programme of the development of Kafue National Park as model of sustainable economic use in a management extensive environment" notes that the withdrawal of the World Bank funds was*" apparently due to a weak policy and institutional environment to support investment and expansion of the tourism sector (delays with the revision or endorsement of Zambia's wildlife policy and wildlife act as well as the tourism policy and tourism act); unsatisfactory cost-benefit analysis of proposed large-scale investments in KNP; and limited implementation period of 5 years to achieve intended results".

Our interviews with stakeholders have highlighted recurring themes[69] :

- Market demand for both Zambian Tourism and in particular Kafue National Park is low
- Regulatory constraints due to limited leases and the lack of a transparent institutional framework act as a barrier to investment
- Poor road infrastructure, and associated services (petrol stations, rest stops)
- Expensive domestic air travel

We interviewed international hotels located in Lusaka – and not one would invest in the Kafue National Park at this current time, without changes in regulation and market demand.

[67] ZAWA meeting 30-10-2012
[68] Meeting with ZAWA, 30-10-2012
[69] Appendix 1.7 Interview with local Hotels

4. REDD+ project intervention

Forests provide a range of valuable ecosystem services including: climatic regulation, water regulation, soil protection, habitats for biodiversity, and sources of fodder, fuel and food. Deforestation will exacerbate both the biophysical and socio-economic vulnerability of Zambia in the face of climate change. Rural areas and communities reliant on forest resource extraction and traditional farming systems will be some of the hardest hit.

Potential carbon market linked REDD+ project interventions, such as the proposed Sesheke REDD+ project in Western Province, present an opportunity to generate carbon market revenues to support activities that address the drivers of deforestation. Proximate drivers include traditional 'slash and burn' farming methods and timber extraction for charcoal and wood fuel production.

Critical to the success of any REDD+ intervention will be the ability to provide improved and climate resilient alternative livelihoods to forest dependent communities. Supporting such communities in adoption of 'climate-smart' agricultural interventions (i.e. through combinations of agro forestry and sustainable soil management) that improve the productivity and biophysical residence of farm systems will be key.

Carbon market opportunities for REDD+ activities are likely to be restricted to the voluntary carbon market, at least in the short-medium term. However the voluntary market has often been a source of innovation, piloting new project activities and approaches. There is an opportunity for the IFC to support innovative approaches that combine multiple forest and agricultural land management interventions at a landscape level.

4.1.1. Current challenges faced

4.1.1.1. Deforestation in Zambia

Zambia's national deforestation rate is estimated to be approximately 1.5% per annum[70]. This is one of the highest rates of deforestation in the world. This equates to 250,000-300,000 hectares of forest loss each year. This trend of forest loss is set to accelerate, particularly in forest loss 'hot spots' along the rail link between Livingstone and Chililabonbwe, cutting through Southern, Lusaka, Central and Copper belt provinces[71].

4.1.1.2. Drivers of deforestation in Zambia

There are four key proximate drivers of deforestation in Zambia. These are agricultural expansion into forest areas, mining and infrastructural development, wood extraction (especially for charcoal production), and anthropogenic induced wild fire. Each of these is described in the table below.

Key proximate drivers of deforestation in Zambia

Driver	Description
Agricultural expansion into forest areas	Agriculture is a significant driver of deforestation in Zambia. Population increases, coupled with low yielding extensive farming practices, drive the need for expansion of lands under cultivation. This in turn drives the need to clear forest areas. Conventional smallholder agriculture systems involve clear felling of trees to allow for

[70] Mitwa et al. (2012). *Drivers of deforestation and potential for REDD+ interventions in Zambia*. UN-REDD Zambia national programme policy brief

[71] Vinya, R., Syampungani, S., Kasumu, E.C., Monde, C. & Kasubika, R. (2011). *Preliminary Study on the Drivers of Deforestation and Potential for REDD+ in Zambia*. A consultancy report prepared for Forestry Department and FAO under the national UN-REDD+ Programme Ministry of Lands & Natural Resources. Lusaka, Zambia.

Driver	Description
	ease of weeding and fertiliser application. Crop residues and other non-edible biomass are typically burnt during field preparation. This reduces the level of nutrients in the soil and thus the systems fertility. Farmers typically compensate for declines in fertility by opening up natural forests for cropland[72]. Shifting cultivation and agricultural expansion accounts for approx 90% of forest cover loss in Zambia[73].
Mining and infrastructural development	Urbanisation and industrialisation can result in clearing of forest areas to make way for infrastructural developments such as buildings and roads. This is especially the case where mining developments are concerned. Furthermore, mines typically attract an inward surge of population, increasing demand for timber for construction and energy purposes. (see underlying factors contributing to deforestation section below)
Wood extraction	Wood extraction for fire-wood and charcoal is a significant driver of forest degradation in Zambia. Per capita consumption of firewood is over 1000kg/yr in rural areas and 240 kg/yr in urban areas[74]. Wood fuel production contributes 3% of national GDP. Central and Copperbelt are the key charcoal hot-spots in Zambia. Poor agricultural productivity forces many households to intensify non-agricultural livelihoods as a risk mitigation strategy. Charcoal production to meet the increasing demands of expanding urban areas, is one such strategy being adopted by more and more rural households in Zambia that face increasingly irregular harvests and food shortages. Tobacco curing and brick making are key indirect drivers of wood extraction.
Anthropogenic wild fire	Fire is a natural component of miombo vegetation. However increased frequency of poorly managed fires can contribute to woodland loss and stifle natural regeneration processes. Common causes of anthropogenic fires are: illegal charcoal making inside forest areas; and hunters burning vegetation to access prey.

Each of these proximate drivers is influenced by a range of underlying factors. These include: legal, socio-economic, policy, demographic, institutional and environmental factors[75]. Each of these underlying factors is summarised below.

Underlying factors that influence drivers of deforestation

Underlying Factor	Description
Policy and legal frameworks	Robust and enforceable policy and legal frameworks related to natural resource management are essential to securing sustainable use of forests. To date in Zambia there has been limited political will to implement and enforce the natural resource management legislation that exists. A lack of clear benefit sharing mechanism guidelines for Community Based Natural Resource Management approaches (CBNRM) has also impacted the efficacy of forest conservation efforts. To be successful the benefits generated from CBNRM activities must do more than compensate for the opportunity costs of avoided deforestation and degradation. However in reality these rarely do[76].
Land tenure and property rights	Secure property rights provide further incentive to sustainably manage natural resources. In Zambia a lack of secure tenure has contributed to overexploitation of forest resources. The majority of forest areas in Zambia remain open access without clearly defined or enforced property rights[77].
Socio-economic	Poverty restricts households from adopting sustainable forest management practices. The majority of rural households in Zambia (which are generally the poorest) remain

[72] Mitwa et al. (2012). *Drivers of deforestation and potential for REDD+ interventions in Zambia*. UN-REDD Zambia national programme policy brief
[73] ibid
[74] ibid
[75] ibid
[76] ibid
[77] ibid

Underlying Factor	Description
	reliant on wood fuel extraction to meet subsistence energy needs and for short term coping strategies during times of low yields and food insecurity[78].
Demographic	Areas of high population typically correlate to areas of high deforestation pressure. In-migration into areas can accelerate deforestation as demand for wood fuel and agricultural lands increases[79].
Institutional framework	Low capacity of staff and low wages has restricted national institutions (e.g. ZAWA) from sustainable management of forest resources and enforcement and protection of national parks and forest reserves. Out of the 489 forest reserves in Zambia, 170 have been heavily encroached and 109 partially encroached.[80]
Environmental factors	Climate change is an environmental threat magnifier that contributes to accelerated pressure on forest resources. Reducing farm yields, and increasing poverty levels, forces the increased intensification of farming systems, and increased reliance on short term coping strategies such as charcoal production. These trends are set to intensify. In addition droughts, resulting from irregular weather patterns caused by climate change, can contribute to the higher intensity of burning of wild fires.[81]

4.1.2. Impact of these challenges

Deforestation will continue to exacerbate both the biophysical and socio-economic vulnerability of Zambia in the face of climate change. Rural areas and communities reliant on forest resource extraction and traditional farming systems will be the hardest hit.

Deforestation also contributes to soil erosion. This is especially the case in sloped areas. Increased incidence of extreme weather events such as heavy rains resulting from climate change will exacerbate this situation. Soil erosion has the following negative impacts:

- Siltation of waterways restricting access to water for agricultural and livestock purposes;
- Siltation of waterways and dams can have negative implications of hydro-electricity production potential; and
- Erosion of farm soils can negatively impact farm yields and the biophysical resilience of the farming system in the face of future extreme weather events.

In addition to soil protection, forests offer the following ecosystem services[82] which will each be negatively impacted through continued deforestation in Zambia:

- Forests provide a micro-climate, and help to regulate rainfall patterns. Forest loss can therefore exacerbate impacts of droughts;
- Forests are a key component of biodiversity, directly and through provision of habitat for other species. Forest loss therefore reduces the resilience of the ecosystem at large; and
- Forests help to regulate water regimes by intercepting rainfall and regulating its flow. Forest loss therefore increases risks of floods and droughts.

[78] ibid
[79] ibid
[80] ibid
[81] ibid
[82] http://www.fao.org/docrep/w7714e/w7714e05.htm

4.1.3. Intervention description

4.1.3.1. What is REDD+

Reducing Emissions from Deforestation and forest Degradation (REDD) is primarily a mitigation activity that can deliver adaptation, livelihood and biodiversity co-benefits. The '+' in REDD+ refers to activities that can enhance sequestration of carbon in forest stocks and landscapes. This could be achieved by:

- Regeneration and or rehabilitation of degraded forest areas;
- Reforestation of deforested areas;
- Introduction of Improved Forest Management (IFM) regimes in actively managed forest production areas; and
- Introducing agro forestry and 'climate-smart' agricultural practices into neighbouring agricultural lands to achieve holistic landscape level interventions.

4.1.3.2. Scales of implementation and sources of finance for REDD+

REDD+ can be implemented at project, regional or national level. Project level activities are typically supported through carbon credit revenues generated through voluntary carbon markets (i.e. Verified Carbon Standard).

Regional or National REDD+ strategies are typically supported through bilateral and multilateral programmes (this is especially the case as capacity is being built at the institutional level through the 'readiness stage'). Such programmes include: the World Bank's Forest Carbon Partnership Facility (FCPF), the UN-REDD programme (of which Zambia is a participant), and the Global Environmental Facility (GEF). Once national capacity has been developed, national REDD+ programmes may look to link themselves to performance based or carbon market linked funding. However as of yet, at a national level, only Brazil via the Amazon Fund[83], has demonstrated sufficient capacity to realise either of these funding avenues.

4.1.3.3. Sesheke district REDD+ project

The REDD+ intervention being considered for IFC support through the PPCR in Zambia as part of this scoping assessment, is the Sesheke District REDD+ project[84]. The project concept has been developed by company AP based in Cape Town, South Africa, a corporate finance and private equity business. Company AP has been mandated by the Barotse Royal Establishment to develop the concept and to contract company AO and other NGOs to implement community development projects. Company V have been identified as a potential investor into the project. As per the Project Idea Note (PIN)[85]:

The project aims to avoid deforestation and degradation of forests in the Sesheke District of Zambia through the development of a REDD+ project. This project is the first in a series of projects that will be developed within the boundaries of the 1.5million hectare Sesheke Conservation Project. It is expected that this first project will cover an area of approximately 90,000- 150,000 ha.

The project will implement REDD practices that will:

- *Protect and conserve the forests from encroachment by local communities and prevent illegal activities in the protected areas such as logging and agriculture.*
- *In partnership with the local communities enforce the protection and conservation of the forest and the replanted degraded and deforested areas.*

[83] http://www.climatefundsupdate.org/listing/amazon-fund
[84] Company AP (2012). *Sesheke District REDD+ project phase one: Project Idea Note*. Unpublished.
[85] ibid

- *Community based projects will be developed to further provide alternative livelihoods to the communities living in the Sesheke Conservation Project area.*

As per the PIN[86] the location of the project area, current forest management situation and drivers of deforestation in the project area are as follows:

The project area falls within the greater Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA); however, KAZA consists of 37 different national parks, game reserves and game management areas along with large tracts of communal tribal land. The vast majority of the Sesheke District is made up of this tribal land and, as such, has absolutely no conservation status or formal protection at present.

Currently the only sources of income derived from the protected areas by the local communities are precisely those that are causing the deforestation and degradation of these areas. This situation is likely to continue and worsen unless an alternative and sustainable form of income can be provided.

The primary activities causing deforestation and degradation in the project area include:

- *Use of forest land for agricultural purposes, primarily through slash and burn agricultural practices*
- *Regular and uncontrolled burning due to ignorance and the absence of a practical fire management plan*
- *Timber in the protected areas is used as fuel wood and to produce charcoal both for local domestic use and for sale on external markets*
- *Damage to the forest cover as farmers seek fodder for cattle in the dry season*
- *Unsustainable commercial teak harvesting operations and illegal sawmills targeting high value timber species*

As per the PIN[87] the project plans to address the above drivers of deforestation through implementation of the following community based interventions:

- *Degraded forest areas will be replanted with a suitable mixture of indigenous tree species. This will result in the regeneration of the forest and improve the richness of species found in the forests. This process will be implemented and managed by employees sourced from the local communities;*
- *Agro-forestry and sustainable agriculture techniques will be transferred to local communities who will be assisted with the implementation of these techniques. Markets will be developed to provide sustainable revenue for the produce from these projects;*
- *The harvesting of timber for charcoal will be managed and controlled to ensure that this is done in a sustainable manner. This will ensure that the income derived from charcoal is maintained while the impact on the protected areas is reduced;*
- *The project will implement plans and procedures to reduce both the frequency and impact of fires in the protected areas. The development of these plans and procedures will be done in conjunction with the local communities who will be employed to implement and maintain them;*
- *Development of plans to better manage the retention and storage of water in the rainy season. This will allow for better utilisation of scarce water resources in the dry season, thereby reducing pressure on the forest for fodder;*
- *The project developer will develop plans to ensure the sustainable harvesting of non-timber forestry products (NTFP) – such as honey – to the benefit of the local community;*
- *Local communities will be supported in the development of ecotourism products. Markets for the sale of these products will be improved due to the increased levels of ecotourism and the plans will be developed after consultation with private tour operator; and*
- *Other community projects related to infrastructure, job creation, alternative livelihoods, renewable energy, health and education will be implemented with a focus on understanding climate change and readying the community to cope and manage with the impacts of climate change.*

[86] ibid
[87] ibid

4.1.4. What is the climate resilience rationale

As outlined in section 3.2.2 of this report, continued deforestation poses significant threats to biophysical and socio-economic resilience of Zambia, and climate change looks set to magnify this risk. Activities that successfully address the underlying causes of deforestation can safeguard the ecosystem services provided by forests, and enhancing the resilience of forest dependent communities.

In addition to the benefits identified in section 3.2.2, specific resilience benefits identified in the PIN[88] document include:

The project will lead to the rehabilitation of the biodiversity of a vast natural area and the generation of value from its wild fauna and flora resources, the generation of carbon revenue and the harvesting of sustainable non-timber forestry products.

This will further lead to improved levels of carbon sequestration and carbon stocks, improved soil fertility and maintenance, water retention, watershed protection and hydrological regulation.

The project area is strategic for biodiversity conservation, being habitat for a wide range of animals within Zambia. These include all of the large charismatic mammal species (except for rhino which has already been hunted to local extinction). Carnivores, including lion, leopard, cheetah, wild dog and hyena, still survive within the project area, albeit it in very limited numbers due to high levels of poaching and widespread snaring as these animals have absolutely no value to the local population at present.

The project area also comprises habitat for rare antelope species, such as the sable and roan antelope, but undoubtedly its most critical and unique value is that it covers one of Africa's oldest and most important elephant migration corridors between the Chobe region of Northern Botswana and the Kafue region of Zambia.

The project area is also home to some rare endemic avian species, such as the black-cheeked lovebird.

Non-timber plant species will be encouraged at the outset and during the early years to allow development of NTFPs for local and export markets. These species are also selected for the additional ecosystem service functions that they provide, including, for instance, suppression of lower storey weeds (which reduces competition with planted tree species), improvement in fire management (through suppression/ physical breaks), and biodiversity enhancement.

4.1.5. Adherence to the PPCR framework criteria

The REDD+ project could contribute to achieving the objectives of the following components of the Zambia specific SPCR performance monitoring table[89], however this largely depends on the promotion and successful adoption of 'climate-smart' agricultural interventions as key components of the community development plans:

To strengthen the adaptive capacity and livelihoods of vulnerable farmers and rural communities to climate change and variability in priority areas of the Kafue and Barotse sub-basins

The REDD+ intervention could help deliver the following targeted results:

- *Reduction in crop area affected by floods and droughts in similar intensity events in the two sub-basins*
- *Increased private sector investment in climate-resilient activities in the two sub-basins*
- *Vulnerable Social Groups effectively participate in climate resilient activities*
- *Diversified agriculture and sustainable NRM introduced in pilot site.*

[88] ibid
[89] Climate Investment Funds (June, 2011). Strategic Programme for Climate Resilience in Zambia. Annex 1.

4.1.6. Investment description

For the scale of the project identified in the PIN document, company V has indicated that it is not in need of any additional finance to implement the project as proposed[90]. However it would be interested in exploring options for IFC support to increase the scale and scope of the project below what is proposed in the current plans.

The following potential options exist for IFC investments to support the REDD+ intervention:

- The IFC could provide grant finance to support the technical costs in development of the PDD and baseline assessments. One opportunity could be to provide grant funding to support the technical development of new 'landscape' level GHG accounting approaches that could cover both forest based and 'climate-smart' agriculture sequestration benefits. This could be especially effective if climate-smart soya was identified as an effective mechanism to reduce the pressure of shifting cultivation methods on forest resources and developed in the context of a wider REDD+ activity (see 'climate-smart' smallholder soya intervention).

- The IFC could make a forward investment to support project development costs of a larger project concept, in exchange for future streams of REDD+ carbon credits generated[91].

- The IFC could make investments in 'stand alone' community development initiatives separate from the direct REDD+ investment opportunity. These could be piloted with communities currently contributing to the deforestation of the Sesheke project area, that directly address the proximate and underlying causes of deforestation in the area. These could include investments via the 'access to finance' intervention or the 'climate-smart' smallholder soya intervention. [92]

4.1.7. Operating arrangement

The Royal Barotse Establishment has established company AP which will have overall management control of the project and the community development activities. Company AO and other NGO implementers will be contracted by the conservation company to implement specific projects. A detailed community development plan is currently being formulated by company AO[93]. This should provide more detail on the operational arrangements for individual community activities. Company V has been identified as forward investors in the development of the project.

4.1.8. Market and technical risks involved

4.1.8.1. Carbon market risks

The carbon market offers the potential to generate a financial return from REDD+ activities. A number of different carbon markets exist, including:

- **Compliance emissions trading schemes:** Compliance trading is regulated by governments through 'cap and trade' markets. With total emissions limited under the 'cap', each entity covered by the scheme is allocated (or required to buy) allowances that give it the right to emit a portion of the total cap. Trading of allowances between installations allows greater flexibility and reduces the cost of meeting emission reduction targets. The largest compliance trading scheme by far is the European Union Emissions Trading Scheme (EU ETS). However additional compliance carbon markets are emerging. These include emission trading schemes in Australia, South Korea, and the State of California (USA).
- **Project based carbon credits under the Clean Development Mechanism (CDM):** Under certain conditions it is also possible for emitters regulated under compliance trading schemes to buy

[90] Conversation with stakeholder G at company V on 11th October 2012.
[91] This was an idea of particular interest to stakeholder G at company V.
[92] Due to limited information being available from companies V and AN pertaining to specific plans and costing for community interventions, it has not been possible to explore the viability of the A2F and 'climate-smart' soya interventions in the context of the Sesheke REDD+ project further.
[93] Company AO was unwilling to share the details of the draft community development plan until they received clearance from the Royal Barotse Establishment.

credits from projects which offer emission reductions through other activities, known as 'project based credits'. The CDM seeks to encourage low carbon investment and sustainable development in developing countries by permitting industrialized countries to finance GHG emission reduction projects in those countries in return for additional credits. CDM credits are eligible for surrender by both sovereign states for Kyoto target compliance, and businesses in the EU ETS.

- **The voluntary carbon market:** Outside of the regulated markets a voluntary market for carbon offsets has emerged. This market represents an active demand by businesses and individuals for some form of action on climate change in the absence of direct regulation. Through the voluntary market, projects offering GHG emission reductions can sell credits, offering purchasers the opportunity to offset their emissions.

Any REDD+ crediting initiative must identify the appropriate source of demand before designing a project, as it must align itself with the methodological and governance requirements of that market. While a number of compliance carbon markets exist or are emerging, the eligibility of REDD+ credits originating from Zambian project level activities seems extremely limited until 2020 at the earliest. The table below summarizes the challenges related to eligibility of Zambian REDD+ credits in the context of the key compliance markets.

Compliance emission trading scheme opportunities for Zambian REDD+ projects

Compliance emission trading schemes	Considerations in relation to opportunity
EU ETS	Land use and forestry credits currently ineligible under phase III of the scheme (2012-2020)[94]
Australian ETS	The Australian ETS plans to link itself to the EU ETS. To facilitate this linkage; the scheme will adopt the same eligibility criteria for international offset types. Therefore opportunities for use of international REDD+ offset types appear limited until 2020 at the earliest.
South Korea ETS	No international offsets until 2020 of any type.
New Zealand ETS	Imported forestry credits from projects based outside of New Zealand are not currently eligible
California ETS (AB32)	International REDD+ credits originating from jurisdictional REDD+ activities eligible from 2015 onwards. However only credits originating from jurisdictions that have a bilateral MOU in place with the state of California as part of the Governors Climate and Forest Taskforce (GCF) will be eligible. Participation also requires MRV systems to be established at the jurisdictional level[95]. To date MOUs are in place with the states of Chipas (Mexico), Acre (Brazil) and Ache (Indonesia) only.

Currently the CDM Executive Board limits eligible land use CDM activities to just afforestation and reforestation (A/R), and even for these categories it awards only temporary credits that have limited fungibility with other traded carbon credits. The CDM therefore offers limited potential for a forest carbon project development of any type in Zambia.

Given the ineligibility and restrictions associated with use of credits from land use projects in existing compliance trading schemes and under the CDM, the voluntary carbon market currently offers the greatest potential for generating income from REDD+ project level activities in Zambia. The voluntary market has often been a source of innovation, piloting new project activities and approaches. Unlike the compliance markets, credits from land use and forestry projects have long played a role in the voluntary carbon market.

[94] Shneck et al. (2011) Demand *for REDD Carbon Credits: A Primer on Buyers, Markets, and Factors Impacting Prices*. Working Paper
[95] Peters-Stanley et al (2012). *Leveraging the Landscape: State of the Forest Carbon Market 2012.*

According to the *2012 State of the Forest Carbon Market report*[96]the volume of REDD credit transactions fell by 62% from 2010-2011 with a total of 7.4Mt of credits transacted. However despite the drop in volumes, credit prices increased to an average of 8.5 USD per tonne[97].

4.1.9. Technical risks

Developing a carbon market linked REDD+ project is technically demanding. Below is some elaboration on three key technical challenges identified in relation to the Sesheke REDD+ project concept presented to us by company V. It is important to caveat that this assessment has been based in the limited information made available to us on the REDD+ project concept, and does not include any primary analysis. These challenges do not rule out the possibility of REDD+ project development in Sesheke, but are issues that could require further due diligence as part of a comprehensive feasibility assessment.

Baseline overestimation: The carbon revenue potential of the project correlates to the baseline emissions profile of the project (i.e. the emissions resulting from deforestation and forest degradation activities in the business as usual scenario). At present no detailed analysis has been undertaken to evaluate this. However the project developers are anticipating an annual sequestration potential of over 500,000 tCO2e from a 90,000 hectare project area[98]. This includes allowances for a 30% credit buffer. Based on the assumptions in the table below, this suggests the project anticipates reducing the rate of forest loss in the project area by 5.49% per year below the baseline level. However a recent study looking at the historical rates of deforestation by province in Zambia from 1965-2005 reports a historic average annual deforestation rate for Western Province of only 0.2%[99].

Assumptions made in calculation of anticipated rates of avoided deforestation for the Sesheke REDD+ project concept.

	Value	Unit	Source
Project area	90,000	hectare	Company V (email correspondence)
Carbon stock per hectare of miombo	29.94	tC/ha	Berry et al, Inventory of carbon stocks in Mkuwazi Forest Reserve and the Thazima region of Nyika National Park, Malawi (unpublished). (2008)
Reduction in deforestation rate	5.49%	% per annum	Calculated
C:CO2 conversion factor	3.664		CDIAC
Area of avoided deforestation	4,948	hectares/yr	Calculated
Avoided destruction of carbon stock	148,160	tC/yr	Calculated
Avoided release of CO2	542,857	tCO2/yr	Company V (email correspondence)

It may be that the Sesheke area has exceptionally high rates of deforestation compared to the rest of the Western Province at large. If this is the case, it will be revealed during a planned baseline assessment study to be undertaken be confirmed during the upcoming baseline assessment study to be completed by mid 2013.

Ineligibility of the carbon accounting methodology to project circumstances: To achieve project approval under the VCS projects must follow approved methodologies. Methodologies provide "*the core framework for the quantification of carbon benefits and include instructions for the without –project baseline,*

[96] ibid
[97] ibid
[98] Conversation and emails exchanged with stakeholder G at company V.
99 Chidumayo, E.N. (2012). *Development of reference emission levels for Zambia*. Report prepared for FAO Zambia.

measurement and monitoring changes of carbon stocks and the assessment of leakage and project emissions"[100].

Methodologies are supported by a considerable body of scientific research to verify that the proposed activities are likely to deliver the projected carbon benefits. As such they are specific to the type of project and/or locations. If an appropriate approved methodology is not available project developers can develop their own; but this would add to the costs and time to develop a REDD+ project.

Identifying a suitable methodology, requires checking that the project circumstances align with the methodology specific eligibility criteria. Company has identified the following methodology for application in the Sesheke REDD+ project context:

- VCS: VM0009 – Methodology for Avoided Mosaic Deforestation of Tropical Forests.

The eligibility criteria for use of this methodology include the following restriction in its use:

Once forest is converted to agriculture in the reference and leakage areas that conversion is permanent and the land is not allowed to return to forest. This excludes use of this methodology for Swidden or other traditional forest cultivation activities that clear one area to farm for a year or two, and then move on and leave that area to return to forest over decades.

Given the PIN[101] document identified a main driver of deforestation in the project area as '*use of forest land for agricultural purposes, primarily through slash and burn agricultural practices',* this could restrict use of this carbon methodology in the project context. This needs further investigation as part of the final feasibility assessment to be completed by mid 2013.

Delays in the project approval process: The REDD+ project development and implementation process is complex. Undertaking baseline assessments, preparing project design documents and identifying and commissioning third party verifiers presents many technical challenges. Until this process is complete a project cannot start to issue carbon credits. The speed with which a project can successfully navigate these steps depends on the technical capacity at hand and the availability of eligible methodologies around which to develop emission reduction calculations. Typically this process can take anywhere from 18-36+ months.

The project developers have indicated that they anticipate completion of this process and issuance of first credits by March 2014. This could be regarded as highly ambitious, especially given the potential requirement to develop a project specific methodology.

4.1.10. Critical success factors

The following critical success factors should be considering how best the IFC could support development of the Sesheke REDD+ project concept (or other emerging REDD+ project ideas in Zambia):

Technical capacity of project developer: Carbon market linked REDD+ projects can be technically very challenging to implement. Having sufficient technical resources to develop baseline assessments, prepare project design documents, respond to queries raised during validation and verification processes, and provide ongoing Monitoring, reporting and verification (MRV) functions will be critical to the project's success. The IFC could consider how best it can support project developers in filling any technical capacity gaps identified.

Developing community livelihood activities that successfully address the underlying causes of deforestation: successfully generating alternative and improved livelihood opportunities for forest dependent community members is critical. If this is not achieved, leakage risk will be high (i.e. geographical displacement of deforestation pressure to a nearby unprotected area).

[100] Olander, Jacob and Johannes Ebeling. *Building Forest Carbon Projects: Step by Step overview and Guide. In building forest carbon projects, Johannes Ebeling and Jacob Olander (*eds.) Washington, DC: Forest Trends, 2011.
[101] Company AP (2012). *Sesheke District REDD+ project phase one: Project Idea Note*. Unpublished.

In Zambia, rural poverty and food insecurity are two of the key factors driving deforestation activities. Smallholders reliance on traditional farming techniques for mono-cropping maize cultivation, quickly deplete the nutritional base of soils within their farm plot through seasonal burning crop residues and other available biomass. These factors force households to shift farm plots every 2-5 years, often into forest areas, to sustain yields and meet subsistence food needs. A second consequence of traditional slash and burn agricultural systems is that as organic residual matter is removed and burnt, and the soil organic carbon content of depleted, the water holding capacity of soils is reduced, and susceptibility to soil erosion increases. This in turn exacerbates the biophysical vulnerability of the farming system to extreme weather events such as floods and droughts. As incidences of extreme weather events increase as a consequence of climate change, households will increasingly be forced to turn to deforestation activities (such as charcoal production) as a short term livelihood diversifying coping strategy.

Enhancing resilience and profitability of agricultural systems through supporting adoption of 'climate-smart' agricultural practices, that enhance the resilience of agricultural systems through improvement of soil condition, should form a pivotal strategy to reversing this trend and should form a key component of any REDD+ interventions in Zambia[102]. However for this to prove successful, effective linkages to markets, technical assistance, input suppliers, and credit providers will be important (see 'climate-smart' soya intervention for more details). Any interventions improving agricultural productivity/profitability will need to be implemented in conjunction with effective land use planning measures, to ensure that enhanced profitability does not incentivise further deforestation in the long term into protected areas.

A consideration for PPCR funding could be to support the further development of 'climate-smart' agricultural benefit accounting methodologies (covering both mitigation and adaptation benefits) and their application in the context of smallholder agriculture. This could support the realisation of holistic landscape level REDD+ interventions that address the multiple challenges of food security, adaptation and mitigation.

Effective community consultation and communication throughout the project: Successfully achieving REDD+ objectives requires significant behavioural changes to be adopted amongst forest dependent communities. It is therefore essential that community groups are made central to project development plans and consulted regularly throughout the planning and implementation phases of the project. Special attention should be made to include vulnerable and marginalised groups in decision making process (i.e. women headed households, elderly etc.) as it is typically the poorest households that are most heavily reliant on forest resources and who potentially face the greatest opportunity cost in adoption of avoided deforestation activities.

Effective communication and endorsement from national authorities charged with developing the national REDD+ programme: Under the UN-REDD programme Zambia is currently developing its national REDD+ strategy. It is important that the project developer communicates its REDD+ project concept plans with the relevant authorities to understand how MRV systems and crediting activities fit within the planned national REDD+ framework. This will be especially important as decisions are made at a national level as to how project level activities will be credited under a future national programme.

4.1.11. Challenges

In addition to the market and technical risks identified above, a key challenge may be the perception of REDD+ as primarily a mitigation mechanism. Zambia has not been identified as a participant country in any of the World Bank CIF mitigation funds (including the Forest Investment Programme). Therefore it would need to be confirmed that it is appropriate for a carbon market linked REDD+ project opportunity to be promoted through the PPCR.

[102] Kokwe et al. (2012). *Forest management practices with potential for REDD+ in Zambia.*

5. Recommendations for development of a landscape level REDD+ project

Summary of the opportunity
Developing a REDD+ project that accounts for the emission reductions achieved from avoided deforestation activities, forest degradation activities, and also through adoption of 'climate-smart' agriculture systems in the wider landscape, could provide a pioneering and transformational 'proof of concept'.

Given the absence of any 'landscape' level REDD+ projects globally, upfront investment will be required in development of innovative landscape level accounting methodologies, and data collection systems to support monitoring, reporting and verification of mitigation impacts. However once developed, additional carbon (or payment for ecosystem service) revenue streams could provide complimentary funding to support wider community development projects, provision of agricultural TA services, and general park management activities. While carbon market financing opportunities could be limited to voluntary sector in the short run, alternative public sector performance based funding mechanisms (i.e. BMZ's REDD Early Movers programme[103]) could potentially provide alternative financing options to support such a proof of concept.

The project represents an opportunity to pilot innovative approaches to GHG accounting including:
- Use of GHG modelling for forest and CSA systems to underpin simplified activity based monitoring across landscapes
- Use of ICT technologies to reduce costs and technical errors in data collection and processing
- Use of web-based data management systems to simplify validation and verification processes and increase transparency in evaluation of project impacts

There is also the potential opportunity to develop and pilot a complimentary adaptation benefit accounting framework, to implement in conjunction with the mitigation accounting methodology, to allow for measurement and reporting of the holistic climate change benefits of the programme.

Steps needed in the technical development of the project

1. Consultation with key stakeholder groups to determine project structure and scope

- Consultation with key stakeholders to delineate geographic boundary of the project, scope specific CSA systems to be promoted amongst smallholder participants, scope human infrastructural design for collection and processing of MRV data, and delineate specific land use areas.
- Determine under what standard (or donor requirements) any carbon accounting methodology will be developed and the technical implications.

2. Baseline assessment

- Time series analysis of satellite imagery to determine site specific deforestation rates, and surveys to determine drivers and agents of deforestation.

3. Development of activity based landscape level GHG accounting methodology

- Development of GHG modelling approaches to enable activity based monitoring of the specific forestry and CSA systems to be protected and adopted respectively.
- Field sampling to validate and parameterize use of the GHG models developed.

4. Design and testing of MRV systems

- Design of simple ICT applications for activity based data collection
- Design of web-based data MRV and management system to facilitate automated computation of mitigation

[103] www.bmz.de/en/publications/topics/climate/FlyerREDD_lang.pdf

impacts (and potentially resilience and adaptation co-benefits)
- Field testing of combined ICT / web-based MRV system

5. Capacity building in use of ICT technologies and web-based MRV

- Capacity building with MRV officers and field staff in use of ICT data collection technologies and web-based MRV system

Indicative timeframes

	Month							
Step	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
1.								
2.								
3.								
4.								
5.								

Potential pit-falls and risks to consider

- Identifying the most appropriate financing mechanism for the emission reductions achieved at the outset is critical. For example: if performance based donor funding is targeted, tier 2 GHG accounting in line with IPCC best practice guidelines may be sufficient. This could reduce the technical complexity during implementation of the methodology, and allow for implementation across a larger geographic scale.
- It will only be possible to generate accurate estimates of the mitigation potential of the project after steps 2 and 3 have been completed. It may be this is insufficient to be economically viable.
- There are several potential scenarios that could potentially result in smallholders 'dis-adopting' CSA. This represents a potential non-permanence risk to the project.
- MRV commitments under the project will need to run for 20+ years. It is important that the project puts in place appropriate long term funding and organisational structures to support these activities throughout.
- Land tenure issues could complicate benefit sharing arrangements for carbon revenues. Benefit sharing options should be assessed at the outset of the project[104].

[104] www.profor.info/node/2111

6. Programmatic Integrated Intervention

In this section we consider how all of the interventions could be successfully combined to deliver the benefits outlined in the REDD+ landscape project.

In this section we propose how the following named interventions could be integrated in a pilot site

Interventions to be integrated:

- Access to Finance – Agricultural Finance
- Access to Markets – Soya Production
- Agro Processing
- Tourism & wildlife based land use

REDD+ landscape project The PPCR programme is based on a fundamental principle of participatory adaptation, and in order for the private sector to be able to support investments that also deliver climate resilience benefits, it is vital that local communities are involved in the process and that the interventions are appropriately tailored to the various regions in the Barotse and Kafue sub-basins.

It is proposed that in order to integrate the individual proposed interventions, in a manner that could result in a the implementation of a successful REDD+ landscape project – that an additional grant funded component is incorporated to provide additional support to embedding interventions with local communities, in an manner appropriate to local challenges and opportunities.

Grassroots Trust[105] works with local communities to improve natural resource management and income. Their approach is one of holistic management of the land, to manage nutrient flow in the soil and water retention. Their approach is one of partnership with communities – and they are actively developing relationships and concepts with communities across Zambia.

Their approach has several tenants, when working with communities:

- Provide a holistic management context to the management of land, using a seven step decision making methodology[106], to support communities to identify key objectives and the way to attain them, including commercial opportunities
- Introducing locally relevant climate-smart agricultural practices into communities
- Encouraging water retention via land cover associated with positive agricultural practices[107]
- Agro-forestry via pruning of cut down tries - a labour effective, regeneration of forests
- Improved natural resource management rules (for example fishing) agreed by communities for net benefit for all
- Building of wildlife land use conservancies in the country's chiefdoms helping communities make more from their resources
- Holistic planned grazing for livestock and effective wildlife land use management
- Improved marketing and making linkages with established buyers and private sector players

The advantage of investing in this community focused approach to support the embedding of any of these interventions would be two-fold. Firstly, to ensure buy-in and compliance for the proposed interventions, but also to continue the process of identifying and implementing viable climate resilience projects, to be implemented with private sector support. The process of engaging the private sector and realising the economic benefit of using Zambia's natural resource in a sustainable and effective manner

[105] The Mwembezyi Nature Conservancy in the Kafue sub-basin (near to Mumbwa district) may be interesting to explore further.
[106] Allan Savory, Holistic Management methodology
[107] This approach has been successfully used in Niger. See. "Reforesting the Sahel: Farmer Managed Natural Regeneration", PJ Cunningham and T Abasse

would realise significant benefit for the Zambian economy and deliver climate change adaptation benefits.

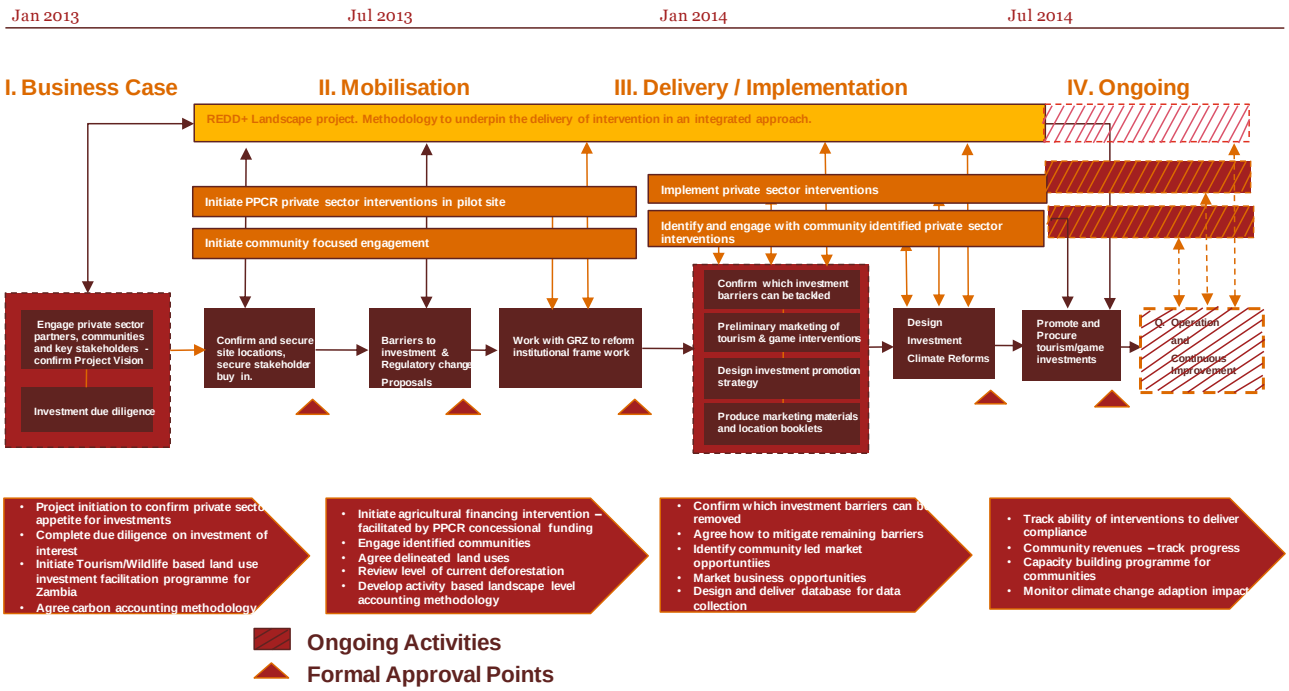
6.1.1. Intervention Description

Key Features of such an integrated approach would include:

- Participatory Adaption approach to implementation
- Integration of existing private sector opportunities, community led private sector opportunities into a REDD+ landscape project

- Pilot site potentially to be located in the Greater Kafue National Park Area or another national park
- Depleted GMA's - could provide a location of pilot sites for wildlife based land use
    - Phased approach

Roadmap



1

6.1.2. Private Sector Interest

The company W is a Special Joint Venture (SPV) between companies X and Y in Zambia, who have both invested $35 million each into the venture, with the remainder of the project financed through a combination of shareholder loan and debt finance.

The Africa Development bank through the Africa Carbon Support Programme (ACSP) is assisting company W to develop the CDM component, of the hydro power project – by providing technical advice. A CDM prior consideration note has been submitted to ITPC, the Zambia Designated National Authority (DNA) and the United Nations Framework Convention on Climate Change (UNFCCC), and

the project has been posted on the UNFCCC website. The PDD is complete and has been sent to the DNA for validation submission.

An initial estimate of emission reductions (CERs) to be achieved by this project is 360,000 tCO2/year. There are four international carbon off-takers who have expressed interest in the project, and have detailed the prices at which they would be prepared to off-take the carbon emissions.[108] All revenues from this project have to be re-invested into environmental projects and the corporation has expressed interest in exploring whether this revenue can be used to help the programmatic integrated intervention.

6.1.3. Challenges/ Critical Success Factors

- Complex Programme, which is high risk
- Communities need to be engaged as primary partners, and trust needs to be built
- Enhanced ability for communities to benefit from diversified livelihoods, however timescales in which benefits can be realised need to be clearly communicated
- Intervention not purely private sector/commercial. Hybrid approach of loan and grant money – sustainability of this approach needs review
- Climate change adaptation benefits can be demonstrated; however private sector engagement with climate resilience does not always produce traditional/orthodox climate change adaption projects.
- The link between climate resilience and private sector relies on multiple dependencies, model/methodology by which private sector can be engaged into this sector still under debate on a global level
- Partnerships need to include companies that qualify from citizen economic empowerment – and capacity of local business to engage with these opportunities need to be developed

[108] Itezhi Tezhi Hydro Power and Transmission line project, Zambia. Project Appraisal Report, 2012, Africa Development Bank Group
IFC: Pilot Programme for Climate Resilience (PPCR) - Private Sector Support to Climate Resilience in Zambia

7. Key Assumptions

7.1. Assumptions

In undertaking our detailed investigations on any of the interventions, we will rely on data provided by industry experts (e.g. agronomists, environmentalists, etc.) and various private sector participants. We will rely on this data to produce the financial models and although we will seek to verify these figures in as far as possible, we will not provide any assurances to the accuracy of any financial data provided to IFC.

- The total number of interventions to be investigated further will be restricted to the following interventions: Access to Finance, Climate Smart Agriculture & Agro processing, Game Management & Tourism, REDD+ programmatic integrated intervention.

- Although we will identify potential private sector organisations who have expressed interest in investing in a climate change adaptation interventions, we will not undertake detailed investigations on these private sector organisations to establish their credit worthiness and ability to implement any identified interventions and we make no comment on the financial or technical capacity of these companies to undertake the identified climate resilient investments

- During the assignment, we have had discussions with a number of stakeholders with whom we have discussed various concepts and interventions which they may have proposed by these stakeholders. We will not be held responsible in the event any of these concepts/interventions are not adopted by IFC.

- Any decisions regarding investable interventions by the IFC or any other stakeholder will be their sole decision and based on advice from us, from other advisers and their own commercial assessment.

- Our recommendations will not be construed as expressing or implying any opinion as to the achievability or otherwise of any intervention.

8. Disclaimer

This report has been prepared in accordance with the terms of our engagement and for no other purpose. We do not accept or assume any liability or duty of care for any other purpose or to any other person to whom this document is shown.

This report contains information that has been obtained from various sources as indicated in the report. We have sought to establish the reliability of these sources as far as possible, however, no representation or warranty of any kind (whether express or implied) is given by PricewaterhouseCoopers Limited to any person as to the accuracy or completeness of the information.

Appendices

A.1. Economic Matrix

A.1.1. World Bank Climate Resilience Adaptation criteria

Intervention	Fire risk management	Agriculture under climate change conditions	Water retention / management	Soil retention / vegetative cover	Generating income from carbon markets	Scoring
Smallholders soya production	N/a	High	High	High	Medium	**11**
Indigenous crop production	N/a	High	High	High	Medium	**11**
Promotion of renewable biomass fuels for cooking	Medium	N/a	Low	High	High	**9**
Green villages concept	Medium	Low	Low	Medium	High	**9**
Renewable charcoal production (bamboo/miombo)	Medium	N/a	Low	High	High	**9**
Establishment of private sector water user association and water security fund	N/a	N/a	High	High	Low	**7**
Sustainable game management and game farming	Medium	N/a	Low	Medium	N/A	**5**
Smallholder livestock production and rural abattoirs	N/a	Medium	N/a	N/a	Medium	**4**
Revamping tourism	Low	N/a	N/a	Medium	N/a	**3**

Scoring key	
High	3
Medium	2
Low	1
N/a	0

A.1.2. Transformative criteria

Intervention	Use of innovative technologies	Scalability of the intervention	Provides access to finance for vulnerable communities	Provides access to markets for vulnerable communities	Scoring
Smallholders soya production	High	High	High	High	**12**
Indigenous crop production	High	High	High	High	**12**
Smallholder livestock production and rural abattoirs	Medium	High	High	High	**11**
Renewable charcoal production (bamboo/miombo)	High	Medium	N/a	Low	**6**
Green villages concept	High	Low	Low	Low	**6**
Promotion of renewable biomass fuels for cooking	Medium	Medium	N/a	N/a	**4**
Sustainable game management and game farming	Low	Low	N/a	N/a	**2**
Revamping tourism	N/a	Low	N/a	N/a	**1**
Establishment of private sector water user association and water security fund	N/a	Low	N/a	N/a	**1**

Scoring key	
High	3
Medium	2
Low	1
N/a	0

A.2. Prioritisation of intervention dashboards.

The initial assessment of potential interventions was captured into dashboards that were presented in the interim report. [Sensitive information has been removed from the tables in A.2.]

These are reproduced below (further investigation for the final report has revealed that some interventions such as wild life land use /game management – are more feasible and appropriate for a PPCR project, than initial investigations suggested):

Access to Finance (A2F)

Access to Finance	**1**
Provision of finance services/loans to smallholder and potentially emergent farmers, for activities that adhere to a specified climate change adaptation criteria. Provision of extension serviced delivered by Farmer Business Advisors – who are paid a commission for the successful completion of defined transactions.	

Sector(s):	**Finance/Agriculture**	
Key private sector stakeholder(s)	Providers of finance, agriculture inputs (hard and soft) and off-take agreements to support this intervention. This intervention does not depend on off-take agreements.	Support Required: Credit line to the financial institutions
Other stakeholders	Providers of technical assistance to FBA's on climate smart agriculture methods.	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance
	✓✓	✓✓	✓✓

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	N/A
Use of innovative technologies	Medium	Fire risk management	N/A
Scalability of the intervention	Medium	Water retention / management	High
Provides access to finance to vulnerable communities	High	Agriculture under climate change conditions	High
Provides markets for vulnerable communities	High	Soil retention / vegetation cover management	High

Who else do we need to speak to? Agribusiness and farmers' unions
Follow up conversations with financial institutions, companies AR and H
Potential partners: Companies A, C, AA, AB and B – Indicated willingness to work with the IFC to provide financial support to farmers.

Access to Finance	1

Company AC – is interested in partnering with this intervention, and extending FBA methodology to commercialise additional activities (such as relationship with off takers)

Indicative feasibility: 

Based on discussions with stakeholders, there is a significant small holder farming market that could be targeted with this product. It is estimated that 7% of the population – equating to 1.5 million households are smallholder farming units dependent on agriculture

The ZNFU membership is 300,000 and the successful loan programme A (targeting the larger emergent farmers) is only servicing 2 – 5% of this membership base. The loan programme A is oversubscribed – there were 14,000 applications for 10,000 loans in 2011 indicating a significant appetite and market for finance products in this sector.

Considered for further investigation 

- Understand the costs associated with provision of technical assistance to small holder farmers by companies AC and AS.

Smallholder Soya Production

Smallholder soya production	**2**

Description: Promotion of Soya production by smallholder farms in combination of climate smart agriculture to diversify from current maize dependence. Establishing a route to market with private sector players and providing for small holder farms to access finance for quality inputs (including seed, fertilizer, implements and irrigation equipment).

Sector(s):	**Agriculture**	
Key private sector stakeholder(s)	Providers of off take agreements, finance and agricultural inputs.	Support Required: Smaller holder farmers need to be able to access finance and technical assistance for soya production as defined in the Access to Finance intervention
Other stakeholders	Value chain developers, farmers' unions, farmers' cooperatives and MFIs.	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance
	✓✓	✓✓	✓✓

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	Medium
Use of innovative technologies	High	Fire risk management	N/A
Scalability of the intervention	High	Water retention / management	High
Provides access to finance to vulnerable communities	High	Agriculture under climate change conditions	High
Provides markets for vulnerable communities	High	Soil retention / vegetation cover management	High

Who else do we need to speak to? Agribusiness and farmers' unions

Follow up conversations with financial institutions, companies AR and H

Potential partners: Company H – Indicated willingness to provide market to small scale farmers and to work with IFC, however exact investment requirements yet to be determined. Companies A, AA, AB and B – Indicated willingness to work with the IFC to provide financial support to farmers.

Indicative feasibility: High

Based on discussions with stakeholders, soya production at small holder level is profitable and can deliver significant food security benefits when grow in rotation with maize. Large market and willingness from large processors to provide off take agreements.

Market demand appears to be high. Only 200,000 of soya produced in Zambia in 2011. Company H alone have demand for 100,000 per annum and in 2011 were only able to procure 90,000 within Zambia.

Smallholder soya production	2

Considered for further investigation 

- There is potential to enter the soya value chain, for example a potential product discussed with company N was a branded-soya milk. Sold as healthy local produce.

Agro Processing/Indigenous crop production

Indigenous crop production	3

Description: Promoting the cultivation of indigenous crops and food products using climate smart agricultural techniques among smallholder farmers. Establishing routes to market via local, regional and national bulking centres and processing facilities, managed in partnership by farmer groups/cooperatives/agribusinesses.. Provision of extension services and financial services to buy and use inputs (Seeds, irrigation, fertiliser) . Lending arrangements could be underpinned by off take agreements.

Sector(s):	**Agriculture**	
Key private sector stakeholder(s)	A provider of access to market to smallholders by entering into off take agreements. A provider of access to market and the value chain, for local indigenous products . Using market incentives and pricing to drive positive climate change adaption behaviours. Supported by Community Service Centres - providing extension services and driving compliance to positive behaviours. Providers of agriculture inputs	Support Required: **Company O** may require financing for establishment of additional regional bulking centres and a multipurpose processing facility potential in the Kafue sub-basin to service both Barotse and Kafue sub-basins. Company N would need investment to scale up their Agro processing facility in Lusaka – to be able to scale up their agro processing service to service more areas nationally in particular the Kafue and Barotse sub-basins. Both organisations would benefit from IFC Advisory services, company N – strategy development, company O – strategy development and marketing.
Other stakeholders	Value chain developer, retailer, farmers'unions and MFIs.	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance
	✓✓	✓✓	✓✓

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	Medium
Use of innovative technologies	High	Fire risk management	N/A
Scalability of the intervention	High	Water retention / management	High
Provides access to finance to vulnerable communities	High	Agriculture under climate change conditions	High
Provides markets for vulnerable communities	High	Soil retention / vegetation cover management	High

Who else do we need to speak to? Retailers and farmers' unions.

Follow up conversations with financial institutions and agribusiness forum

Indigenous crop production	3

Potential partners: Companies N and O – Indicated willingness to provide technical assistance and off take agreements to small scale farmers for nutritious indigenous crops. Companies A, AA, AB, and B – Indicated willingness to work with the IFC to provide financial support to farmers.

Indicative feasibility: 

Based on initial discussions with stakeholders, a scaled market exists (local and international) for processed indigenous crops.

Considered for further investigation ?

- Understand demand levels for company O's indigenous products;

Wildlife land use / Game Management and Tourism Investment

Tourism Investment	4a

Description: Create an enabling investment climate to facilitate the growth of tourism and encourage investment. Tourism intervention designed to catalyse economic activity and protect national game parks – dependency on addressing regulatory and infrastructure challenges. These activities could be implemented in partnership with local tour operators, Zambia Tourism Board (ZTB) and ZAWA. These activities could drive wider investment in the region.

Sector(s):	**Natural Capital**	
Key private sector stakeholder(s)	**Various tour operators**: develop marketing strategies **Hotel Chains:** develop new lodges	Support Required: IFC Advisory services to facilitate an enabling investment climate
Other stakeholders	ZAWA, ZTB, TNC, WWF, lodges and safari companies.	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	N/A
Use of innovative technologies	N/A	Fire risk management	Medium
Scalability of the intervention	High	Water retention / management	Medium
Provides access to finance to vulnerable communities	High	Agriculture under climate change conditions	N/A
Provides markets for vulnerable communities	High	Soil retention / vegetation cover management	N/A

Follow up conversations with ZAWA, company AT, TNC

Potential partners: Whilst no potential investors at the moment, the support requested from the IFC is to apply a structured investment methodology with the object of facilitating large scale tourism investments in Zambia. The challenges posed by stakeholders indicate that in order for a sustainable investment to be identified, regulatory and market demand need to be addressed.

Indicative feasibility: Medium

Interviews with various stakeholders revealed a level of optimism about the potential of tourism in Zambia, whilst being pragmatic about the current challenges faced. There was a positive response by stakeholder to receiving support from the IFC to address institutional challenges.

Sustainable game management and game farming

4b

Description Develop enabling investment climate support from IFC - to be able leverage wildlife user rights to commercialise game ranching opportunities more effectively than currently in Zambia.
Promoting the establishment of game ranches and game breeding areas within the GMAs to allow for sustainable restocking of wildlife levels in the parks, safari hunting, sale of live animals and game meat production. e.g. Impala, Eland, Buffalo. Game management intervention to develop to benefit local communities.

Sector(s):	**Agriculture and Natural capital**	
Key private sector stakeholder(s)	**Game farmers and Retailers:** Wildlife Producers Association, **Potential off takers/meat processors:** steady supply and access to reliable market	Support Required: Advisory –enabling investment climate Investment to support communities to buy shareholdings in private-community joint business ventures
Other stakeholders	ZTB, ZAWA, TNC, WWF, Africa Development Bank, and other conservation NGOs	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	N/A
Use of innovative technologies	Low	Fire risk management	Medium
Scalability of the intervention	High	Water retention / management	N/A
Provides access to finance to vulnerable communities	High	Agriculture under climate change conditions	N/A
Provides markets for vulnerable communities	High	Soil retention / vegetation cover management	Medium

Who else do we need to speak to? All stakeholders

Potential partners: No private sector partners identified, at this stage – however investment options are restricted to current game management and wildlife user rights – which have been identified as significant barriers to investment currently.
There is currently a longer study being completed in Zambia "An assessment of the scale, benefits, potential sand constraints associated with the wildlife ranching industry in Zambia"[109], being funded by the Wildlife Producers Association Zambia This study is unpublished and is not due to complete until March, however preliminary findings indicate investment opportunity for the private sector, when working in a long term private community partnership – assuming that that the community are legally empowered to realise revenues from this investment.

[109] Lindsey et all

Sustainable game management and game farming	4b

Indicative feasibility: 

Based on initial discussions with companies H and Q and stakeholder A, And there was debate amongst the stakeholders as to whether there is a viable game market. [IFC notes that there are words missing from the previous sentence.] Company H felt that the market demand was low; however representatives from company Q felt that the demand for game in Zambia was 'unlimited'. Stakeholders A and B also indicated that the level of game stock in the game parks was so low that it would be a challenge to be able to produce enough game both to restock the game parks on a sustainable level and produce game on a commercially viable basis.

Further investigation based on regional studies indicates that urban market for game/bush meat is typically underestimated with significant game/bush meat businesses being run in countries in the region (Namibia). Game management and restocking (including hunting) would have to be a component of proposed investments.

Promotion of renewable biomass fuels for cooking

Promotion of renewable biomass fuels for cooking	5

Description: Reducing reliance on unsustainable wood fuel sources amongst households and commercial kitchens through promotion of fuel efficient stove technologies and gasifiers, and use of renewable biomass fuels. Production of saw dust pellets in saw mills as an alternative fuel to charcoal and wood fuels. Scale up of company AE's project to install energy efficient cook stoves.

Sector(s):	**Energy and natural capital**	
Key private sector stakeholder(s)	**Mining companies**: Mobilise workforce in adoption of new technologies and fuel sources. Sawmills and producers of sawdust pellets, cook stoves and routes to market.	Support Required: If the carbon market was currently stronger– IFC investment would be to scale up company AE's project. Company AD may require support in product development and equipment, and financing households to uptake the cook stoves.
Other stakeholders	Agri Business Forum, MFI's, Company AE, efficient stove companies and other conservation NGOs.	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance ✓

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	High
Use of innovative technologies	Medium	Fire risk management	Medium
Scalability of the intervention	Medium	Water retention / management	Low
Provides access to finance to vulnerable communities	N/A	Agriculture under climate change conditions	N/A
Provides markets for vulnerable communities	N/A	Soil retention / vegetation cover management	High

Follow up conversations with Mining companies, Rainlands Timber, carbon project developers

Potential partners: Company AE

Indicative feasibility: Medium

Given the deficit of efficient cooking facilities in Zambia it is suggested that a successful and proven project with an established distribution network such as company AE should offer itself for further investment to build it to scale. That is likely to remain the case until CER prices rise back to at prices closer to $7 a metric ton.

Considered for further investigation ?

Further investigation confirmed that at the current available prices for carbon credits the potential for this

Promotion of renewable biomass fuels for cooking	5
project to be investable was limited. A short write up was though prepared and is at Appendix A9.	

Smallholder livestock production and rural abattoirs

Smallholder livestock production and rural abattoirs	6

Description: Promoting alternative livelihoods for smallholders farmers by enhancing the production of livestock (goats, pigs, chicken, and cattle) through provision of extension services and routes to markets for meats and dairy. Development of regional processing facilities with methane capture for power generation. CDM biogas project development.

Sector(s):	**Agriculture and energy**	
Key private sector stakeholder(s)	Providers of access to market to small holders by entering off take agreements, and provision of extension services Providers of access to finance.	Support Required: Companies H and O may require concessional finance for development of regional abattoirs, biogas systems and processing facilities. Commercial banks will require concessional loans from IFC to offer working capital and multi year asset finance.
Other stakeholders	Agribusiness Forum, ZNFU, MFI's, companies AG and AR, and conservation NGOs	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance
	✓✓	✓	✓✓

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	Medium
Use of innovative technologies	Medium	Fire risk management	N/A
Scalability of the intervention	High	Water retention / management	N/A
Provides access to finance to vulnerable communities	High	Agriculture under climate change conditions	Medium
Provides markets for vulnerable communities	High	Soil retention / vegetation cover management	N/A

Outstanding questions/actions

- Understand economics at smallholder level of livestock production
- Clarify terms of lending from commercial banks
- At what levels of production would abattoir facility development make commercial sense?
- Validate willingness of smallholders to participate

Who else do we need to speak to? ZNFU

Follow up conversations with companies H, O, AG and AR, financial institutions, Agribusiness Forum

Smallholder livestock production and rural abattoirs	6

Potential partners: Companies H and O – Indicated willingness to off take livestock, however volumes and support required unclear at this stage. Company A, B, AA and AB – In principle, indicated willingness to work with the IFC to support the livestock sector, however acknowledged economies of scale and technical requirements could be barriers.

Indicative feasibility: 

Based on initial discussions with companies H and O, banks and World Vision, we understand there is large market for pigs, chickens and beef. This intervention can be further considered in conjunction with the Access to Finance intervention

Considered for further investigation ✗

Establishment of private sector water user association and water security fund

Establishment of private sector water user associations and water security fund	7

Description: Water user associations formed by large private sector users in Kafue sub-basin to encourage a participatory approach to water management. Members contribute to a water security fund which is used to make investments into interventions that can achieve shared objectives. (E.g. Rehabilitation of water shed areas, water harvesting activities etc).

Sector(s):	**Agriculture, energy, water and natural capital**	
Key private sector stakeholder(s)	Mining companies, commercial farming enterprises, energy stakeholders	Support Required: Private sector companies may require support in establishment of the water users association and water security fund.
Other stakeholders	Ministry of Energy and Water development, ZAWA, ZEMA	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance
	✓	✓	

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	Low
Use of innovative technologies	N/A	Fire risk management	N/A
Scalability of the intervention	Low	Water retention / management	High
Provides access to finance to vulnerable communities	N/A	Agriculture under climate change conditions	N/A
Provides markets for vulnerable communities	N/A	Soil retention / vegetation cover management	High

Outstanding questions/actions

- Willingness of key private sector water users to form water users associations
- Willingness to contribute funds

Who else do we need to speak to? All stakeholders

Potential partners: Commercial farming enterprises – Significant private sector users of water who would be affected by adverse Government decisions regarding water use. However their willingness to invest is yet to be determined. (Mining companies – Initial discussions with a mining company suggests they would not be interested in contributing to a water fund given their existing obligations to contribute to the Environmental Protection Fund). The lack of response to this initiative may indicate that companies have not considered their business risk (both operationally and in terms of reputational risk) around ineffective water resource management. It may be that IFS may want to consider this intervention in conjunction with another private sector engagement programme being implemented at the moment by GIZ. The GIZ Water Securities programme which involves working with private sector to identify what their particular risks are and the

Establishment of private sector water user associations and water security fund	7

business benefits of addressing them. A potential opportunity to consider further may be for the IFC offer concessional loans via Bank partners to be an appropriate mechanism to fund this activity as a catalyst to joining the GIZ water resource (multi-stakeholder platforms) – which is structure as similar to the Water Associations

Indicative feasibility:

In order for this intervention to prove viable, private sector actors must be willing to i) form a water users association and ii) contribute to a water fund. For the reasons outlined above, an indicative assessment would suggest that there may be challenge getting private sector buy-in and a benefits realisation approach would have to be presented to private sector stakeholders.

Considered for further investigation: ✗

- This is a mechanism to identify future investment opportunities – but there is no investable opportunity at this point
Investigate private sector interest by large commercial organisations and mining entities to form a water users association
- Discuss the water users association concept with private sector organisations and establish if, and how much they would be willing to contribute to a water fund;
- Establish what interventions affecting the water, energy and agriculture sectors the private sector organisations would be willing to contribute the water funds towards (without undertaking detailed feasibility studies)

Green villages concept

Green villages concept	8

Description: Reducing reliance on charcoal and firewood by providing renewable energy options for villages. Households are assessed and supplied with biogas and solar PV technology according to their requirements. Equipment is supplied to village households for free, the community then sign over their carbon rights based on the energy efficiency of their use of bio gas, solar equipment or energy cookstoves – which are then sold on the carbon credit market for profit – which is realised by the provider of the equipment for example Green Knowledge Institute.

Solar powered water pumps support an increase in yield, access to renewable energy sources (such as solar or biogas) supports agro processing activities such as grain milling, water pumping and coolers for preservation. Avoided deforestation and emissions from charcoal, firewood, and diesel fuel for generators, while building the capacity for alternative livelihoods and boosting economic activities. Potential for processing facilities and ICT use in the villages

Sector(s):	**Energy, Natural capital**	
Key private sector stakeholder(s)	Project developers and energy stakeholders	Support Required: There may be a need for support in product development and financing households to uptake the equipment, as well as upscaling in other regions
Other stakeholders	Ministry of Energy and Water development	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance
	✓		✓

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	High
Use of innovative technologies	High	Fire risk management	Medium
Scalability of the intervention	Low	Water retention / management	Low
Provides access to finance to vulnerable communities	Low	Agriculture under climate change conditions	Low
Provides markets for vulnerable communities	Low	Soil retention / vegetation cover management	Medium

Outstanding questions/actions

• Investigate costs of upscaling the technologies • Willingness of project developers to invest in project	• Clarify terms of lending, possibly from commercial banks • Identify other potential project sites

Who else do we need to speak to? All stakeholders

Potential partners: Companies AF and AG – Although we understand they have already piloted the project and are looking to scale up, no private sector players have been identified.

Indicative feasibility: Low

Green villages concept	8

Based on our discussions with company AG, the viability of operating such a project commercially is low and the model of delivery is more closely aligned to a grant/donor funded programme rather than on a commercial basis. The commercial viability of this project appears to be overly dependent on the carbon market. In addition, we have not been able to identify any private sector players who would be willing to invest in this project.

Considered for further investigation: ✗

Renewable charcoal production (bamboo/miombo)

Renewable charcoal production (bamboo/miombo)	9

Description: Promoting sustainable production of charcoal from alternative sources such as bamboo and miombo forest, sawdust briquettes, to reduce deforestation and degradation. Agroforestry may support a renewable supply of woodfuel

Sector(s):	**Energy**	
Key private sector stakeholder(s)	**Project developers**	Support Required: Private sector companies may require support in product development and project upscaling
Other stakeholders	MEWD, ZAWA, ZEMA	

Opportunity for linkages with solutions developed by the other components	Mobile technology	Insurance	Micro Finance
	✓		

Adaptation intervention as defined by the World Bank	✓	Generating income from carbon markets	High
Use of innovative technologies	High	Fire risk management	Medium
Scalability of the intervention	Medium	Water retention / management	Low
Provides access to finance to vulnerable communities	N/A	Agriculture under climate change conditions	N/A
Provides markets for vulnerable communities	Medium	Soil retention / vegetation cover management	High

Outstanding questions/actions

- Viability of the proposition
- Willingness to uptake among households

Who else do we need to speak to? Global Carbon Exchange

Follow up conversations with company AT

Potential partners: No private sector partners identified.

Indicative feasibility: Medium

This intervention was not progressed in the context of this project, as no private sector interest was identified. However, this is an intervention that could be implemented in conjunction with the Soya/ climate smart agricultural intervention.

Considered for further investigation: ✗

A.3. Rockefeller Climate Change Adaptation criteria

This information has been extracted from a set of 'climate-smart' agricultural factsheets, developed by PwC as part of the Rockefeller Foundation funded 'climate-smart agriculture in sub-Saharan Africa project'.

1. Agronomy

Agronomy encompasses various practices in plant management and is used to supplement other sustainable agricultural practices. Agronomy can help farmers achieve: higher yields, improved drought resistance, early crop growth which reduces evaporation loss, shorter growing periods, improved water use efficiency and water productivity, tolerance to salinity, acidity and / or water logging and disease and pest resistance

Agronomy is one of the three principles that underpin what is referred to as “conservation agriculture”, a practice recognised as having widespread potential across Sub-Saharan Africa in enhancing the sustainability of intensive farming systems.

Description of main activities undertaken as part of the practice

- *Improved crop varieties:* introducing an improved variant of a particular crop, such as seeds that improve ability to withstand disease or drought. This may involve using seeds developed through plant genetics or crops from other similar regions that are more robust.
- *Weed management:* reduction of weed infestations by providing cover by crops, residues and mulch, and by minimum soil disturbance.
- *Crop rotation:* planting crops in a specific order to reduce inputs whilst achieving higher yields.
- *Green manure:* use of crops that are green or have just flowered as green manure to add organic matter and nutrients to the soil.
- *Multiple-cropping:* where such as double cropping or triple cropping systems allow two or three crops to be planted at the same time, with no overlap in growth cycle i.e. intercropping, where two or more crops are cultivated simultaneously on the same field which conserves soil and reduces pests/diseases as the different crops planted are unlikely to share the same pests and disease-causing pathogens.
- *Relay cropping:* involves planting of a second crop after the first crop has flowered. Variations include mixed cropping, strip cropping, associated cropping, and alternative cropping.
- *Alley cropping:* the planting of trees or shrubs, including trees which could include nitrogen fixing legumes, in two or more sets of single or multiple rows with agronomic, horticultural, or forage crops cultivated in the alleys between the rows of woody plants.
- *Contour cropping:* this management practice reduces risk of erosion by tilling and planting across (i.e., following the curvature of the land), rather than up and down.
- *Strip contour cropping:* the practice of growing two or more crops in alternating strips along the contour of the land.
- *Earthing / ridging:* covering the root and lower stem of a plant with heaped up soil to maintain soil nutrient and moisture levels.
- *Integrated pest management (IPM):* reducing or eliminating the use of pesticides whilst simultaneously managing pest populations.

Adaptation benefits

- Improved drought resilience through reducing crop water requirements, improving crop varieties and facilitating deeper rooting of crops through cover crops and green manure.
- Facilitates rainwater infiltration and reduces soil erosion and run-off and the risk of downstream flooding e.g. though contour cropping and earthing /ridging.
- Minimises the outbreak of pests and diseases e.g. through use of intercropping and crop rotation.
- Improved soil fertility through the buildup of organic matter and increased capacity of crops to adapt to the local environment improves resilience to climate change and helps to improve the micro-climate.

- Changing planting dates reduces the likelihood of crop failure and maintains production under changing rainfall patterns which increases resilience to climate change and drought/flooding.

Productivity benefits

- Reduces soil erosion and improves soil nutrient content which results in long term sustainable crop yields and reduces the use of inputs such as fertilizers.
- Recycling of nutrients and energy through crop rotation reduces the need for inorganic fertilisers and increases crop productivity.
- Increased volume of crops from the same time period e.g. multiple cropping.
- Improved crop varieties with shorter growing cycles enable farmers to continue farming in regions where the crop season has already diminished.

2. Nutrient management

Nutrient management is the practice of managing the amount, form, source, placement, and timing of nutrient application, using methods and practices that increase organic nutrient inputs, retention and use. The availability of nitrogen and other nutrients is essential to increase yields however when nutrients are applied, they are not always used effectively by crops and surplus nitrogen can create nitrous oxide (N_2O). Effective nutrient management can reduce the volumes of surplus nitrogen and it can reduce the need for synthetic fertilizers which, due to cost and access, are often unavailable to smallholders, and through their production, transport and use, contribute to GHG emissions.

Description of main activities undertaken as part of the practice

- *Application of compost and manure:* from plant residues and domestic livestock to provide sources of nutrients.
- *Mulching:* 30% or more of the soil surface is covered with crop residues from the previous crop after harvest to create a microclimatic conditions more independent of weather conditions.
- *Improved fallow-systems:* using crop or tree species for natural nitrogen fixation.
- *Precision farming:* adjust application rates of inorganic fertilizers based on precise estimations of crop needs and avoid excess applications for immediate plant requirements.
- *Controlled release:* Use of slow or controlled- release fertilizer forms or nitrification inhibitors which slow down the microbial processes leading to N2O formation.
- *Improving timing:* apply fertilizers when least susceptible to loss, often just prior to plant uptake.
- *Deep Placement technologies:* Placing fertilizers more precisely into the soil to make it more accessible to crops' roots.
- *Tapping nutrients (Agroforestry):* trees and plants are mixed with annual crops to bring nutrients from the deep subsoil below the rooting depth of annual crops and return them to the topsoil in the form of mulch and litter (see agroforestry factsheet for more information).
- *Minimum soil disturbance:* reduced or zero tillage systems minimises soil disturbance and leaves more biological surface residues and provide environments for enhanced soil biotic activity (see tillage and residue management factsheet for more information).

Adaptation benefits

- Enhancing levels of soil organic carbon can lead to increased soil moisture retention improving drought resilience.
- Allows the diversification of crops which helps decrease dependence on single commodities and therefore increases the resilience of smallholder farming systems.

Productivity benefits

- Enables productivity increases by supplying essential nutrients.
- Improves soil fertility and soil moisture through various methods including improved timing of application of nutrients and planting nitrogen fixing leguminous species into a fallow. This increases productivity, boosts crop yields and allows more flexibility in types of crops that can be produced.
- From a broader perspective of conservation agriculture, sequestering organic carbon in soil, creating a nutrient rich environment for the proliferation of plants, and allowing water to pass through and be filtered are some critical soil functions that can be enhanced through this practice.

3.Tillage and residue management

Tillage management refers to practices that minimise soil disturbances during land preparation. This has the benefit of stabilising soil structures and increasing organic matter.

Residue management refers to practices which utilise residual biomass from crops and livestock as a form of

organic matter that is incorporated into agricultural soils.

The combination of these practices along with crop rotations are the three principles that underpin what is referred to as “conservation agriculture”, a practice recognised as having widespread potential across Sub-Saharan Africa in enhancing the sustainability of intensive farming systems.

Description of main activities undertaken as part of the practice

- *Reduced tillage (conservation tillage):* reducing soil disturbance in soil preparation through ripping as opposed to ploughing of soils.
- *No tillage:* involves avoiding all soil disturbances except in the exact planting spot.
- *Avoided burning of crop residues in field preparation.*
- *Mulching:* spreading a protective cover of residues on soils to retain moisture, reduce erosion, provide nutrients and suppress weeds.
- *Composting:* application of organic matter by products as a form of fertiliser.
- *Integrative livestock and manure management:* collection and application of animal manure.
- *Trash lines:* made from crop residues, grass and other organic material and constructed along contour lines to reduce soil erosion and reduce surface run. Results in the building of soil deposits along the contour with a terracing effect.
- *Crop composition:* selection of crop composition which produce more residual biomass.

Adaptation benefits

- Builds drought resilience through reduction in soil surface overheating and reduction in diurnal variation of temperature.
- Helps to build up soil organic matter and stimulates soil life (fauna and flora) which has numerous adaption benefits and helps to improve the micro-climate.
- Increases flood resilience and resilience to climate change through reduction of run-off, protection against soil erosion, reduction in evaporation, increased water infiltration and reduction in surface sealing and crusting.
- Increased pest resilience through provision of habitat for predators which prevents pest out breaks.

Productivity benefits

- Use of crop residues and organic fertiliser / manure increases yields through reduction in soil losses, improved soil fertility and soil structure and conservation of soil moisture for crop use.
- Conservation tillage improves productivity due to a reduction in soil erosion, increase in organic matter/soil cover and improved water holding capacity in soils.

4. Agroforestry

Agroforestry is the practice of growing either trees or shrubs in agricultural crop and /or animal production and land management systems. Agroforesty systems are designed to benefit from the ecological and economic interactions of the different components of the system (e.g. trees, crops, livestock, and humans). Agroforestry systems may be used to provide commercial timber; fuelwood; fodder for livestock; organic fertiliser and to improve watershed functions by preventing soil erosion, enhancing infiltration rates, reducing surface runoff and floods, and reducing land degradation.

Description of main activities undertaken as part of the practice

- *Silvoarable: g*rowing agricultural or horticultural crops simultaneously with long term tree crops.
- *Silvopastural:* growing trees within a forage production system for the rearing of livestock.
- *Forest farming (shade systems)*: integrated cultivation of both timber and non-timber forest products in shaded forest understory. Forest farming is separate and distinct from the opportunistic exploitation of wild non-timber forest products.
- *Conservation planting: including* shelterbelts, riparian buffer strips, timberbelts, windbreaks, fence line plantings, and hedgerows designed for both shelter and the opportunity for woody plant harvest and non-timber forest production.
- *Contour plantings:* rows of trees (and sometimes shrubs or vegetative strips) along contours to reduce soil erosion on slopes give some wind protection.
- *Fertility Plantings:* Trees and/or shrubs planted with the main aim of improving nutrient input and/or cycling for a forage or alley crop.

Adaptation benefits

- Diminishes the impacts of extreme weather events such as heavy rains, wind storms and droughts through prevention of soil erosion, stabilisation of soils, prevention of land degradation, enhanced infiltration rates and improved microclimate.
- Enriches biodiversity and increases ecosystem stability through provision of habitat for beneficial insects and birds.
- Allows the diversification of crops and labour resources, which helps decrease dependence on single commodities and therefore increases the resilience of smallholder farming systems.

Productivity benefits

- Improves soil fertility and soil moisture through increased soil organic matter to boost crop yields and allow more flexibility in types of crops that can be produced. Nitrogen fixing leguminous trees and shrubs can be especially important.
- Fodder trees and shrubs can reduce dependence on external feeds and increase livestock carrying capacity.
- Diversification of income streams through the production of timber, fuel wood products and a variety of non-timber forest products.

5. Pasture & grazing land management

Grazing land is a collective term referring to rangeland, pastureland, grazed forestland, native and naturalized pasture, hay land, and grazed cropland. Grazing land is used primarily for the production of forage plants and livestock grazing is a predominant activity.

Communal grazing lands are important sources of feed in developing countries. The uncontrolled and free grazing system prevalent in many developing countries has caused severe degradation of the grazing lands. One of the major aims of pasture & grazing land management is to prevent and control land degradation and enhance productivity, through increased ground cover and improved species composition and productivity.

Description of activities undertaken as part of the practice

- *Improving forage quality & quantity:* Planting improved grass and fodder trees and managing grazing land through land subdivision.
- *Seeding fodder grasses:* Eradication of invasive species and re-vegetation of degraded rangelands using different treatments including over-sowing with grass seed mixture, supplementing with lime, cattle dung, and brush packing.
- *Improving vegetation community structure*: Removal of large trees (deterring grass growth) while protecting fodder trees.
- *Stocking rate management*: managing the number of animals allotted to an area for a given length of time.
- *Rotational grazing*: postponing grazing while forage species are growing or ensuring even grazing of various species, to stimulate diverse grasses, improve nutrient cycling and plant productivity.
- *Land degradation management:* Enclosing and protecting degraded land from human use and animal interference to permit natural rehabilitation; this is enhanced by additional vegetative and structural conservation measures.
- *Fire management:* controlling annual fire regimes to promote enhanced fodder production.

Adaptation benefits

- Slows or halts desertification and provides social security to the poorest people during extreme events such as drought.
- Improves grazing land and pasture, which enhances livestock productivity and resilience to drought.
- Increases vegetative ground cover, which enhances flood resilience as rain water runoff is reduced.
- Increased forage availability over the long term provides greater climate resilience.

Productivity benefits

- Controlling overgrazing and pasture improvement has a favorable impact on livestock productivity (more income from the same number of livestock).
- Productivity increases occur through greater production and better survival of arid rangeland plants (fodder).

6. Watershed restoration

Watershed degradation is a rapidly intensifying problem across much of Africa. As populations and pressures on land grow, the poorest people are forced into more and more marginal and vulnerable areas such as river floodplains and basin headwaters. Deforestation, excessive livestock grazing and cultivation of marginal soils lead to reduction of groundwater recharge and deterioration of watersheds. Watershed restoration is focused on conserving or restoring water quantity and/or water quality, through rehabilitation of watershed ecosystems and drainage basins.

Description of activities undertaken as part of the practice

- *Upslope erosion and sediment control:* such as road decommissioning and upgrades/storm proofing, removal/stabilization of landings, landslide stabilization.
- *Habitat improvement*: such as rehabilitation of riparian zone vegetation.
- *Re-vegetation, assisted rehabilitation, and rehabilitation of degraded areas:* through reforestation and grazing control activities in degraded forest areas, and removal of invasive exotic species, to combat soil erosion and improve rainwater infiltration.
- *Fire management:* implementation of avoided or managed burning regimes.
- *Hydrology:* Restoration of hydraulic and hydrologic flow regimes in stream and estuary ecosystems through construction of check dams, ponds and gully control structures.
- *Storm water management*: managing storm water reduces flash flooding and erosion.

Adaptation benefits

- Reducing runoff volumes through practices such as rain water harvesting and the reduction of sedimentation of waterways reduces the risks of flooding.
- Practices to promote groundwater recharge and sediment control through the use of dams aids drought resilience and helps store water for towns and for agriculture when rainfall is low.
- Restoration of watershed ecosystems and forest areas provides alternative sources of nutrition (mushrooms, honey, and insects) that acts as a safety net during times of low food availability.
- Micro-climatic benefits of reforestation activities.

Productivity benefits

- Productivity increases can be brought about by creating conditions for sustainable soil and water conservation.
- Watershed restoration can enhance soil conservation and on farm water availability, reducing variability of yields and increasing average yields.

7. Water management

Water management involves intervention in the way rain, surface and/or groundwater is captured, conveyed, utilised and drained. Water management can aid production under fully irrigated systems as well as in rain-fed conditions, support livestock, forestry, and fisheries, and interact with important ecosystems.

Water scarcity and insecure access to water for consumption and productive uses is a major constraint to enhancing livelihoods in rural areas. Improving water harvesting and retention and water use efficiency (irrigation systems) is vital for supporting rural livelihoods, increasing production, land rehabilitation and addressing increasing irregularity of rainfall patterns. Some water management practices are dependent on rainwater and involve storing water in the soil, whereas other practices use surface or groundwater. Access to additional freshwater also provides opportunities for multiple uses, including aquaculture and livestock within the production system.

Description of activities undertaken as part of the practice

- *Divert runoff*: diverting excess rainwater by using ditches, terraces, and cut-off drains to avoid leaching of nutrients, soil erosion or landslides.
- *Impede runoff*: Controlling runoff to prevent erosion and allow more time for water to infiltrate the soil using grass strips, bunds, terraces, ridges and furrows.
- *Retain/avoid runoff*: Encouraging water infiltration by using cross-slope barriers, mulching, vegetative cover and minimum/no tillage. This improves water storage within the rooting depth of plants and groundwater tables are recharged.
- *Trap/harvest runoff*: where rainfall is insufficient water is harvested and runoff is concentrated to improve plant performance by using pits, half moons , dams, ponds, pits, retaining ridges.
- *Reducing soil evaporation loss*: reducing water loss through soil cover by mulch and vegetation, windbreaks and shade.
- *Irrigation*: conveyance and distribution of water in an irrigated system. Demand for irrigation water is high and can cause competition.

Adaptation benefits

- Reduced water losses from evaporation, uncontrolled runoff and leakage in irrigation systems, reduces production variability and increases climate resilience provided systems are well-designed and maintained.
- Impeding runoff reduces yield variability due to reduced soil and water erosion and better soil quality; however in heavy rains it may increase production losses.
- Reducing soil evaporation reduces yield variability under drier conditions due to greater moisture retention.
- Diverting runoff reduces yield variability under heavy rainfall conditions due to improved water management.

Productivity benefits

- Irrigation and more effective irrigation measures increases production and contributes to higher yields and greater intensity of land use.
- Impeding runoff can lead to higher yields due to reduced run-off, increased soil moisture and reduced soil erosion. However these structures may displace some crops and lower yields during high rainfall.
- Reducing soil evaporation can increase yields due to greater water retention in soils.
- Diverting runoff can increase yields due to drainage of agricultural lands in areas prone to flooding.
- All practices can enhance carbon storage in soils through enhanced yields and residue returns. This in turn increases the productivity of the crops and the income generation capacity of the farmers.

8. Livestock management

Livestock are important sources of CH_4 emissions, and overgrazing can drive land degradation and deforestation resulting in CO_2 emissions. Livestock management involves practices which reduce methane emissions through improved feeding practices, and enhance animal breeding through improved characteristics of production. Additionally integrated livestock feeding systems can reduce degradation of grazing traditional grazing areas and may increase agricultural production through improvements to soil nutrition.

Description of activities undertaken as part of the practice

- *Improved breeds/species*: selecting breeds or species that are most appropriate for the region and fodder.
- *Watering management:* managing distribution and types of watering facilities.
- *Herd management and behaviour*: normally involves division of the herd into groups.
- *Destocking*: partial herd reductions to optimize performance of the remaining herd relative to forage supply.
- *Calf management:* management of young stock, largely done to avoid losses rather than promote fast growth i.e. decrease in weaning age.
- *Feed management*: substituting crop residues and pasture with nutrients not found in fibrous feed i.e. urea-molasses mineral blocks.
- *Zero grazing:* stall feeding livestock (cut-and-carry and zero grazing).
- *Animal health care:* improving livestock health through activities such as vaccination or dipping of livestock.
- *Manure management*: anaerobic digestion of manure stored as a liquid or slurry, composting solid manures and use of manure instead of inorganic fertilizers.
- *Integrated livestock-crop management system:* manure from livestock is used to enhance crop production, whilst crop-residues and by-products are used as feed for animals.
- *Grazing management:* postponing grazing while forage species are growing or ensuring even grazing of various species, to stimulate diverse grasses, improve nutrient cycling and plant productivity as well as supplementing poor quality forages with fodder trees i.e. in silvopastoral systems.
- *Haymaking*: building up of reserves of fodder as hay for the dry season from surplus in the wet, which helps animals to survive during dry periods without having to overgraze the land.

Adaptation benefits

- Actively herding livestock such as in a pastoral system as opposed to free-range management avoids straining local ecosystems and degradation through overgrazing.
- Diversifying sources of feed increases resilience to climate change.
- Management of grazing increases forage availability and resilience to climate change.
- Appropriate management and application of manure can enhance soil organic matters which in turn can enhance water retention on soils.
- Increased resilience of improved breed or species that can withstand increasing climate extremes.
- Haymaking i.e. ensuring fodder is available during the dry season, can act as a buffer in extreme drought when market prices for animals are very low.

Productivity benefits

- Improving the breed or species increases the productivity per animal for the resources available.
- Feed management contributes to higher livestock yields of both meat and milk due to improved diets.
- Destocking contributes to increases per unit of livestock; however total production may decline in the short term.
- Grazing management contributes to higher yields due to greater forage availability and quality, although this has a potential short term trade-off in terms of the numbers of livestock supported.

9. Integrated Food & Energy systems

Integrated food-energy systems (IFES) are agricultural systems that produce both food and energy. IFES can be broadly categorized into two types:

Diversified IFES: both food and biomass for energy generation are produced on the same land through multiple-cropping systems, or systems mixing annual and perennial crop species. For example agroforestry systems where trees are grown for fuelwood or charcoal production.

Zero waste IFES: use by-products of crop and/ or livestock production to produce energy. Examples include anaerobic digester plants fuelled with animal manure and waste crop residues, and use of bagasse as a cogeneration fuel by sugar mills.

IFES can prove effective at reducing GHG emissions and loss of other important ecosystem services in situations where rural communities rely on unsustainable biomass extraction from natural ecosystems to meet their basic energy needs.

Description of activities undertaken as part of the practice

Diversified IFES activities include:

- Establishment of woodlots on community lands.
- Boundary planting of multi-purpose trees (e.g. fruit, medicine, nitrogen-fixing and fuel wood).
- Boundary planting with oil-seed crops such as jatropha which can be processed into biodiesel.

Zero waste IFES activities include:

- Biogas production through the anaerobic digestion of animal waste in biogas digester units. The resulting slurry can be used as an improved organic fertiliser on crops, or as fish feed in on farm aquacultures.
- Optimal use of biomass through production of fuel briquette from waste crop residues.
- Intercropping with species with high volumes of residual biomass.
- Biochar production through pyrolosis of residual biomass.

Adaptation benefits

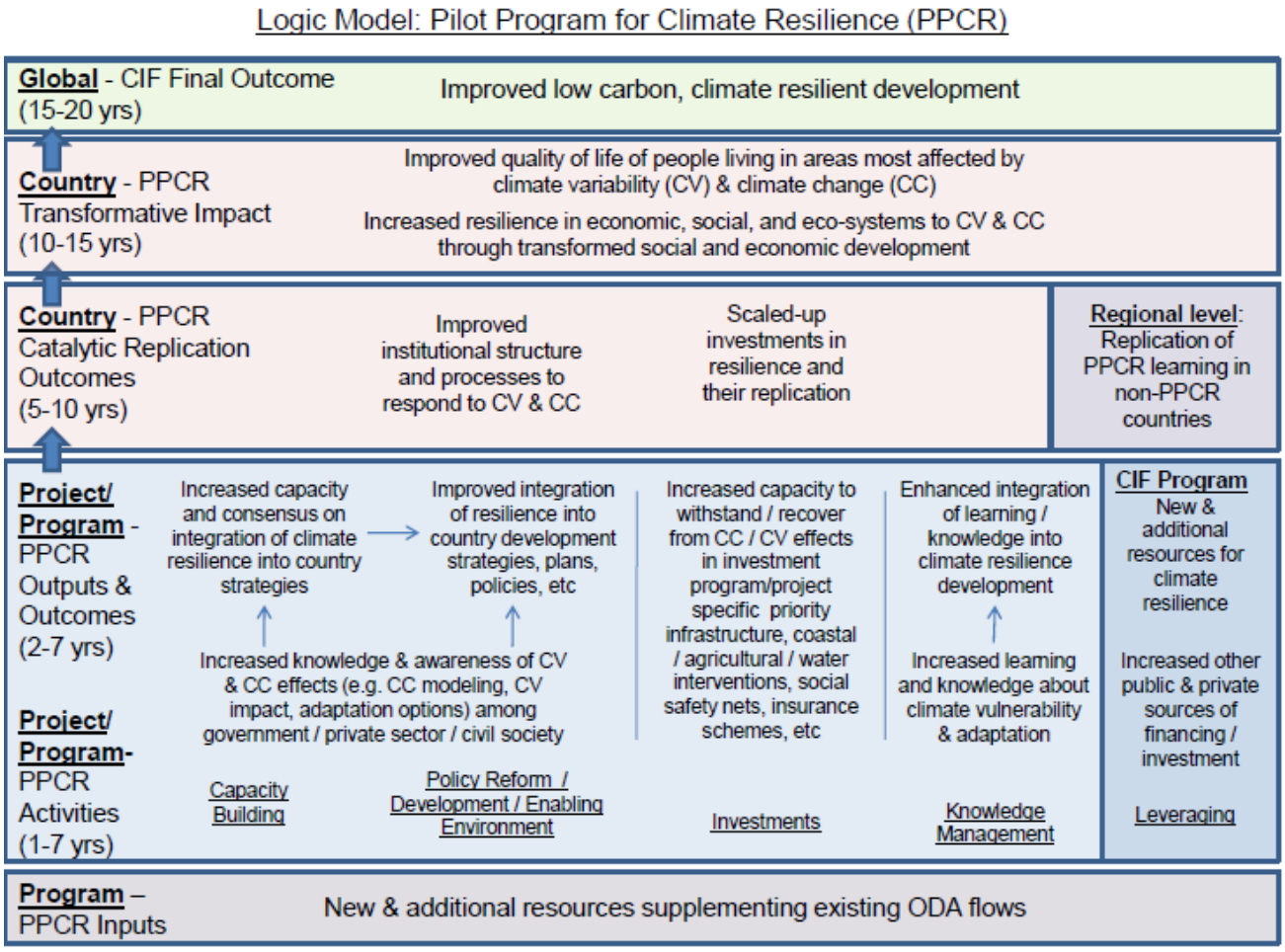
- Use of waste slurry from biogas digesters as a fertiliser on fields enhances soil nutrients, which in turn enhances water retention thereby increasing drought resilience.
- Reducing deforestation pressures through IFES is vital to achieve effective watershed conservation and restoration and avoided soil erosion.
- Boundary planting of multi-purpose trees can have positive microclimate impacts.

Productivity benefits

- Direct productivity benefits can arise from diversified income streams achieved through production and sale of woodfuel and/or sustainable charcoal.
- Soil conservation and watershed restoration enabled through addressing drivers of deforestation can have community wide long-term productivity benefits.
- Indirectly the use of waste slurry from biogas digesters, or N-fixing multi-purpose tree crops as a fertiliser on fields enhances soil nutrients and increases agricultural yields.

A.4. PPCR Results Framework

The interventions presented were considered in the context of the Project/Programme Results frame work as detailed below.



A.5. Case Study 1: Clinton Foundation Anchor Farm Programme, example case study of smallholder 'climate-smart' soya production[110]

The Clinton Foundation Anchor Farm Programme is being implemented in Mchinji District, Malawi. The programme works with smallholder farmers to address the following challenges in agricultural production:

- **Lack of crop rotation**: continued production of maize as the primary crop has resulted in a decline of soil nutrients and yields.
- **Lack of fertiliser**: many smallholders use only a limited amount of fertiliser.
- **Pests and crop disease**: smallholders lack the knowledge to recognise disease outbreaks and lack access to high quality pesticides.
- **Poor quality seeds**: smallholders cannot access high quality seeds, and typically replant poor quality seeds from previous crops.
- **Drought**: smallholder farming systems are typically rain fed and so are particularly vulnerable to water shortages.

Using a 1,000 hectare commercial farm as a base or 'anchor' the programme aims to increase crop yields, improve livelihoods, and reduced climate vulnerability through enabling the following interventions:

- **Training smallholders in adoption of CSA practices** for the production of maize (subsistence crop) and soya (cash crop) in rotation systems. These practices include soil fertility management, crop rotation, conservation farming, and use of fertiliser trees.
- **Providing smallholders with market linkages** to high quality agricultural inputs at wholesale prices; improved sales prices for agricultural crops; and financial services including micro-credit loans.
- **Development of farmer organisations.**
- **Provision of community infrastructures and public goods** using Anchor farm profits.

For the 2011/2012 season the programme had 10,400 farmers registered to participate in the scheme, each with an average land holding of 2-3 acres (0.8-1.2 hectares). It is anticipated that this number will rise to 21,000 for the 2012/2013 season.

Programme stakeholders

The success of the programme relies on building mutually beneficial inter-linkages with a broad number of stakeholder groups:

Table 1: Anchor Farm Programme key stakeholders

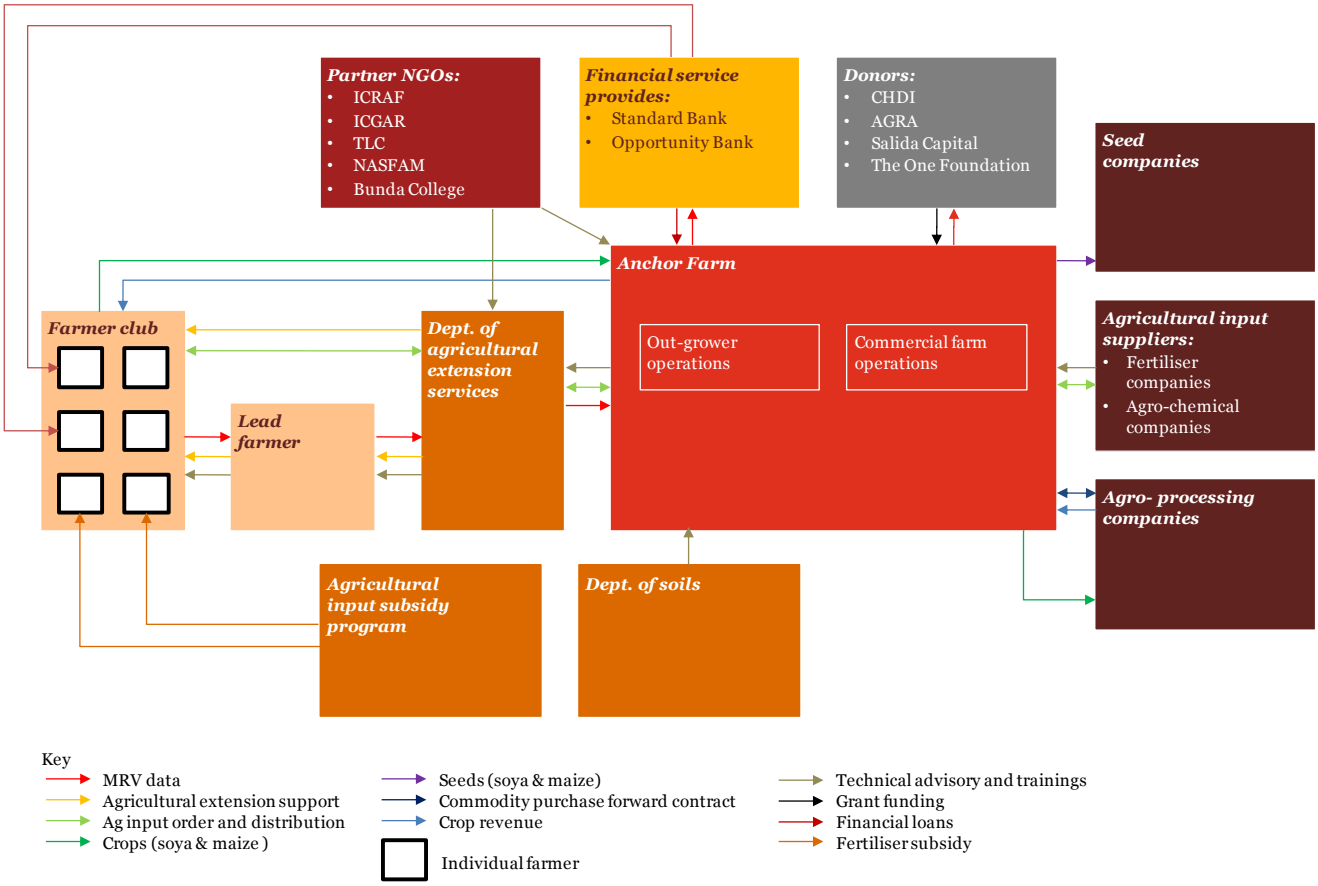
Stakeholder	Role
Individual farmers	Receive CSA training and produce maize and soya crops in rotation systems.
Farmer clubs	Aggregate 10-20 farmers; provide a focal point for extension service provision; coordinate crop collection amongst members; and coordinate agricultural input orders and deliveries amongst members.
Lead farmers	Support extension staff in provision of training to group members and collection of MRV data; receive additional technical assistance and free farm inputs for development of demonstration plot.
Anchor farm out grower staff	Manage extension service delivery and planning; contract with agricultural input providers and agro-processing companies; co-ordinate collection of crops and disbursement of agricultural inputs to small holders; negotiate terms and conditions with financial service providers on behalf of smallholders; collect and manage project performance data.
Anchor farm	Provide hub for collection of procurement of agricultural inputs at wholesale prices; produce crops and seeds for sale at agro-processors and seed companies; provide facilities for research and crop trials;

[110] This case study was developed by PwC as part of a CSA project value analysis, under the Rockefeller Foundation funded, climate-smart agriculture in sub-Saharan Africa project.

commercial farm staff	negotiate forward contracts with agro-processors on behalf of smallholders; negotiate procurement of high quality agricultural inputs at whole sale prices; and produce high quality seeds for distribution to smallholders.
Agricultural input providers	Provide fertilisers, herbicides, pesticides and commercial farm equipment as well as providing training to anchor farm staff. Input providers can benefit from new market opportunities.
Agro-processing companies	Enter into forward contracts for procurement of commercial and smallholder farm produce. Benefit from security of supply of high quality crops.
Seed companies	Buy maize and soya seeds from commercial farm.
Department of agricultural extension services, Ministry of Agriculture	Mobilise farmers into farmer clubs; provide extension support to farmer clubs and ongoing support at individual level; collect MRV data from smallholders; and receive technical training from NGO project partners and programme staff on provision extension service support in CSA.
Department of soils, Ministry of Agriculture	Provide agricultural research services in soil characteristics, and identify optimal fertiliser formulation.
Ministry of Agriculture	Provide fertiliser and seed coupons to eligible smallholder farmers through the farm input subsidy programme.
NGO partners	Provide technical advisory support and training support to programme staff in the areas of: soya production; agroforestry techniques; conservation agriculture; agricultural markets and farmer organisation; and post harvest processing
Financial service providers	Provide commercial loans to the anchor farm; and provision of micro-credit loans and banking services to smallholders. Benefit from new market opportunities and reduce loan default rates.
Donors	Provide grant finance to Anchor Farm

The interactions of the stakeholders listed above are illustrated in the systems diagram below:

Clinton Foundation Anchor Farm systems diagram:



Programme results: food security and improved livelihoods

Through implementation of key interventions, the programme has achieved the following yield and price increases for smallholder beneficiaries:

Table 2: Yield and price benefits for the two primary crops

	Subsistence crop (maize)	Cash crop (soya)
Baseline yield (kg/ha/yr)	1,500	700
Project yield 2010/11 (kg/ha/yr)	4,000[111]	2,600[112]
Baseline price (USD/kg)	n/a	0.30
Project price 2010/11 (USD/kg)	n/a	0.76

On the assumption that the same prices and yields can be secured for crops during the 2011/2012 and 2012/2013 seasons, the programme can be expected to achieve the following food security and livelihood benefits at smallholder and project level respectively:

[111] Project is awaiting yield results from maize test plots in the 2011/2012 season. 4000kg/hectare is an indicative yield response based on discussions with project staff
[112] Based on results from ISFM test plots from 2010/2011 season

Table 3: Food security and livelihood benefits expected at individual and project level 2012/2013

	Average benefits
Additional months of household food security per household per year[113]	21[114]
Additional revenue from sale of soya crop (USD)	879[115]
Additional revenue from the sale of soya crop at the project level (USD)	9,139,394 (2012) 18,454,545 (2013)

Critical Project Success Factors

Availability of reliable large buyers willing to sign and honour pre-season supply contracts - soya crop is currently sold to agro-processer companies, producing fish feed in Malawi, whilst maize supply contracts have been agreed with a South African based grain trader. Contracts are negotiated in the pre-season when market prices are at their highest, providing smallholders with a secure forward price against which to plan season's activities. At harvest, smallholder crop produce is collected and stored at the anchor farm warehouse, before being shipped to the buyer.

Farmer access to high quality farm inputs, including fertiliser, pesticides, herbicides and seeds - these are procured through the anchor farm, and distributed at wholesale prices to smallholders through the farmer group structure.

Access to farm input loans - the project has negotiated lending arrangements between local banks and smallholders. Farmer groups generate peer pressure amongst members for loan repayment

Quality extension service delivery - this is provided by a combination of government extension officers supplemented with additional project staff paid for with grant finance from Agra. Technical training in extension service delivery is provided from a network of NGO partners.

Timely farmer payments - these are made by crop buyers directly into farmer bank accounts.

[113] Calculated on the assumption that average household size is in line with the national average of 4.4 members (GoM, 2008 National Housing and Population Census), and that annual maize requirements are 180 kg per adult and 90kg per child (based on FAO recommendation)
[114] Average input costs for implementation of CSA practices for maize production in 2011/12 are USD 372 per smallholder – as reported by project developer
[115] Average input costs for implementation of CSA practices for soya production in 2011/12 are USD 247 per smallholder – as reported by project developer

Annex 2: example mitigation potential analysis of small-holder climate-smart soya production[116]

Anchor Farm Project

1. Project description

Implementing organisation(s): Clinton Development Initiative

Baseline: Maize cultivation under conventional practices

Activity: Reduced tillage, crop residue return and crop rotation with Soya

Location: -13.82 S, 32.9 E

2. Baseline scenario

The baseline scenario is maize cultivation under conventional practices throughout the project period. As detailed below:

- Prior to planting the field is tilled using hand hoes in October.
- Maize is planted in November.
- Fields are covered by crops during the wet season and prior to harvest (November to April)
- After harvest crop residues are removed and burnt, and fields are left bare from May to November

8.1. 3. Applicability conditions

The modelled mitigation benefits in this summary are applicable to projects in the Mchinji district (location: 13°49'S, 32°54'E), and areas with similar biophysical parameters (see Section 9).

Projects using these estimates should also adhere to the following applicability criteria:

- No trees must be removed as a part of project activities
- Project activities must result in increased yields
- Project activities must be carried out as described in Section 4
- No fertiliser or manure is applied in baseline or project scenario
- Crop residues are not burned or removed from fields
- Project activities do not result in any increase in GHG emissions, or reduction in carbon stocks, outside of the project area

[116] This mitigation analysis was undertaken through use of the Smallholder Agricultural Monitoring and Baseline Assessment (SHAMBA) methodology, developed by PwC in collaboration with a team of researchers at the University of Edinburgh, as part of the Rockefeller Foundation funded, climate-smart agriculture in sub-Saharan Africa project.

4. Project period

Mitigation potential is estimated over a project period of 20 years.

5. Project activities

Project activities include three Conservation Agriculture techniques – reduced tillage and the return of crop residues (the primary crop is maize) to fields following harvest, and rotation with an n-fixing crop (soya), as detailed below:

- There is no traditional tillage (i.e. ridging) and maize is planted using sticks to make plant holes. Herbicides (amount and type not known) are used for weed control. Chemicals (amount and type not known) are used for pest control, and fungicides (amount and type not known) are used to control soya rust.
    - Fertiliser is applied to both soya and maize rotations, at a rate of 115.6kg/ha and 215.7kg/ha respectively.
- Maize is planted in November and harvested in April/May.
- Soya is rotated with maize annually, planted in November with harvest in April/May.
- All crop residues are returned to the soil after the harvest so that fields are not left bare at any point during the year, due to the continuous cover of either residue and/or crop.

6. Additionality

To be assessed

7. Carbon pools and emission sources

Carbon pool	**Included or excluded**	**Justification**
Soil organic matter	Included	The main carbon pool that will be affected by project activities
Above-ground woody biomass	Excluded	Not applicable – If any trees are present they will be unaffected by project activities
Dead wood	Excluded	
Wood products	Excluded	
Above-ground non-woody biomass	Excluded	Yields will be increased by project activities, so conservatively excluded
Below-ground biomass	Excluded	

Litter	Excluded	
GHG Emissions	**Included or excluded**	**Justification**
CH_4	Included	Fertiliser used in the project
CO_2	Excluded	Crop residues are not burned as a part of project activities
N_2O	Included	Emissions from the nitrogen fixing legume Soya

8. Estimated GHG emission reductions and removals

Protocol used: Small Holder Agriculture Monitoring and Baseline Assessment (SHAMBA) tool version 1.0.

Changes to protocol: None

Total mitigation potential (t CO_2e ha^{-1})	44.47 (range 28.87 – 56.74)
Annual mitigation potential (t CO_2e ha^{-1} yr^{-1})	2.22 (range 1.44 – 2.83)

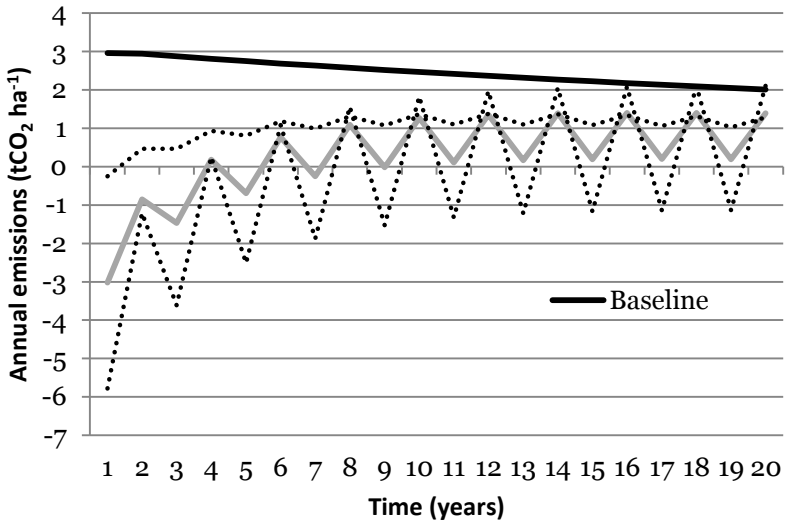


Figure. Predicted baseline and project emissions per hectare (dotted lines above and below project soil carbon indicate stocks under high and low yield scenarios).

9. Data and assumptions

Environmental information

Parameter	Value	Source
Soil organic carbon stocks to 30 cm depth (t C ha^{-1})	45.5	FAO *et al.* 2012
Soil clay content (%)	31.8	FAO *et al.* 2012
Meteorological data	(see below)	IWMI database
Climate classification	Temperate, dry	IPCC 2006

Monthly meteorological data for model parameterisation

Month	Rainfall (mm)	Mean temperature (°C)	Evapotranspiration (mm)
Jan	239.7	22.5	155.4
Feb	218.9	22.5	140.7
Mar	142.6	22.4	160.0
Apr	54.6	21.6	153.2
May	2.3	19.7	147.1
Jun	0.2	17.8	133.6
Jul	0.0	17.6	147.6
Aug	0.0	19.2	188.5
Sep	0.1	22.3	235.6
Oct	9.1	24.3	268.3
Nov	60.2	24.3	224.8
Dec	218.5	23.2	170.7

Baseline and project information

Parameter	Value	Source
Baseline maize yield (t ha^{-1})	1	Implementing organisation
Baseline field cover	Bare May – October	Implementing organisation
Baseline monthly plant input (tC ha^{-1})	0.05 (December – April)	Derived from maize yield
Baseline residue return (t ha^{-1})	0 – burnt	Implementing organisation
Baseline tillage type	Conventional	Implementing organisation
Project Low/Moderate/High maize yield (t ha^{-1})	2/4/6	Implementing organisation
Project Low/Moderate/High soya (t ha^{-1})	1.3/2.4/3	Implementing organisation
Project field cover	All months	Implementing organisation
Project maize monthly plant input (tC ha^{-1}) – average yield maize	0.19 (December – April)	Derived from maize yield
Project maize crop residue input (tC ha^{-1})	1.8 (May)	Derived from maize yield
Project soya monthly plant input (tC ha^{-1}) – average yield maize	0.13 (December – April)	Derived from soya yield
Project soya crop residue input (tC ha^{-1})	1.32 (May)	Derived from soya yield
Project tillage type	Reduced	Implementing organisation
Project residue return amount and month	100%, May	Implementing organisation
Maize harvest index	0.5	Pilbeam (2006)
Maize belowground biomass (%)	26	Kuzyakov & Domanski (2000)
Parameter	**Value**	**Source**
Soya harvest index	0.45	Mabapa *et al* (2010)

Soya belowground biomass (%)	27	Harris *et al* (1985)

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IPCC (2006) IPCC Guidelines for National Greenhouse Gas Inventories. Ed. Miwa K Ngara T Eggleston H S Buendia L and Tanabe K. Agriculture Forestry and Other Land Use. IGES. http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

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Pilbeam, C.J. (2006) Variation in harvest index of maize (*Zea mays*) and common bean (*Phaseolus vulgaris*) grown in a marginal rainfall area of Kenya. *Journal of Agricultural Science*, 126: 1-6.

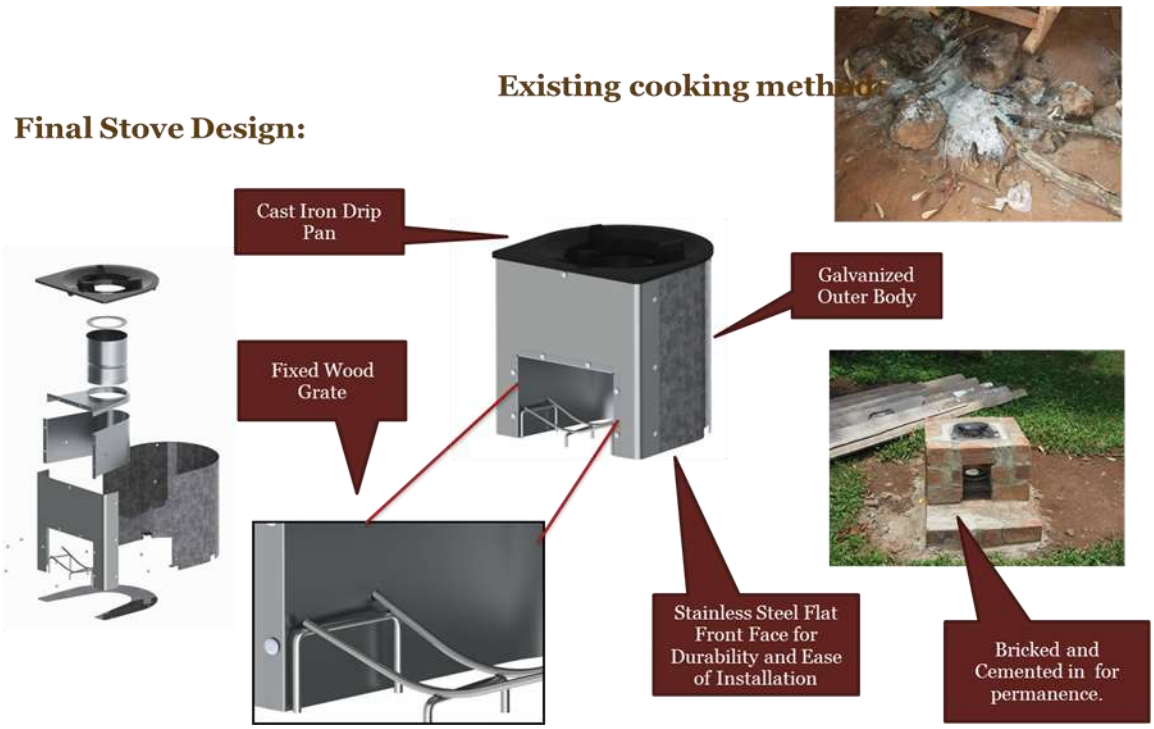
A.6. *Promotion of fuel efficient cook stoves*

The intention of the company AE's project is to install 50,000 energy efficient stoves across Zambia. These stoves are provided at no cost to the end user in Zambia although the unit cost of the stove is c. $40 with installation costing around an additional $5 according to location. They have deliberately chosen to distribute the stoves cost free to the recipient as that allows the focus to be on stove distribution rather than be hampered by supply and demand economics. The roll out began in July 2011 and current project period will finish in June 2013. Currently, some 24,000 stoves are installed and a further 16,000 are on order.

The project has the potential deliver significant Greenhouse Gas (GHG) emissions reductions of approximately 3 tonnes of CO_2 equivalent per stove per annum, resulting in an expected 660 thousand tonnes of Certified Emission Reductions (CERs) in total over the entire accreditation period, assuming the stove retains its efficiency and is still being used by the recipient. Early evidence gathered by the project team is suggesting usage levels of up to 90%.

The project can demonstrate potential for high levels of environmental, health and social co-benefits. In 2006 the Government Zambia set itself a target for 100% access to modern fuels by 2030[117]. At this time approximately 84% of all households in Zambia rely on biomass (wood and charcoal) for cooking. This figure rises to 98% in rural areas. As of 2009, just 0.4% % of the population that rely on solid fuels for cooking were using improved cooking stoves[118]. According to the WHO the health effects of indoor smoke released by burning solid fuels included 8,700 deaths from pneumonia, COPD and lung cancer in Zambia in 2004[119]. Other health-related impacts associated with biomass cooking include: burns and scalds from open fires or semi-open stoves; risk of injury and violence (primarily to women) while collecting wood; and missed time from school for older children involved in fuel collection. As well as leading to excessive environmental degradation and emissions, the time spent collecting solid fuel also imposes opportunity costs that constrain socio-economic development generally[120].

[117] Republic of Zambia. 2006. Fifth National Development Plan 2006-2010, PRSP
[118] Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia and Macro International Inc. 2009. Zambia Demographic and Health Survey 2007. Calverton, Maryland, USA: CSO and Macro International Inc.
[119] From WHO 2009, Country profiles of environmental burden of disease, accessible at www.who.int/quantifying_ehimpacts/countryprofiles
[120] UNDP 2009, The Energy Access Situation in developing countries - A Review Focusing on the Least Developed Countries and Sub-Saharan Africa



Intervention

Description

The project is funded by US$ 2.1 m of shareholder loans, which is has been sufficient to roll out 24,000 stoves, register the project with the UN and to cover start up costs. In addition a prepayment on an ERPA of US$1 million will fund the next 28,000 stoves.

Company AE has partnered with Africa Carbon Credit Exchange (ACCE). ACCE is a Zambian company regulated by the Securities and Exchange Commission of Zambia. Its founder and chairman is a former CEO of the Lusaka Stock Exchange and current chairman of the National Economic Advisory Council. ACCE's role is to provide advice and assistance with local issues in relation to the project

A team has been recruited and includes an experienced regional director and project manager, as well as a number of permanent and temporary staff.

The stoves are being supplied by Envirofit, a US-based company primarily funded by the Shell Foundation who have already supplied over 160,000 stoves to households in India.

A trust will be established whereby company AE will donate 5% of net sales to community projects.

The current status of the Stove Installation plan is as follows:

	Stoves Ordered	Stoves installed	Stoves Installed per week	% of households regularly using the installed stove
As of 1/11/2012	> 38,000	24,000	1,000	85% - 90%

To date project milestones include:

- Design documentation uploaded to the UNFCCC website
- First stove Order – December 2010
- Host Government Letter of Approval issued

Company AE now anticipate the project to be registered with the UNFCCC (http://cdm.unfccc.int/ProgrammeOfActivities/request_reg.html) in the first quarter of 2013 and for the first revenues to be received thereafter. The current project period should conclude by the middle of 2013.

Challenges/ Critical Success Factors

Given the deficit of efficient cooking facilities in Zambia it is suggested that a successful and proven project with an established distribution network such as company AE should offer itself for further investment to build it to scale.

That is likely to remain the case until CER prices rise back to at prices closer to $7 a metric ton, and this point in time this intervention is not considered financially viable.

A.7. Zambia Development and Climate Risks (extract from the PPCR 8 SPCR Zambia)

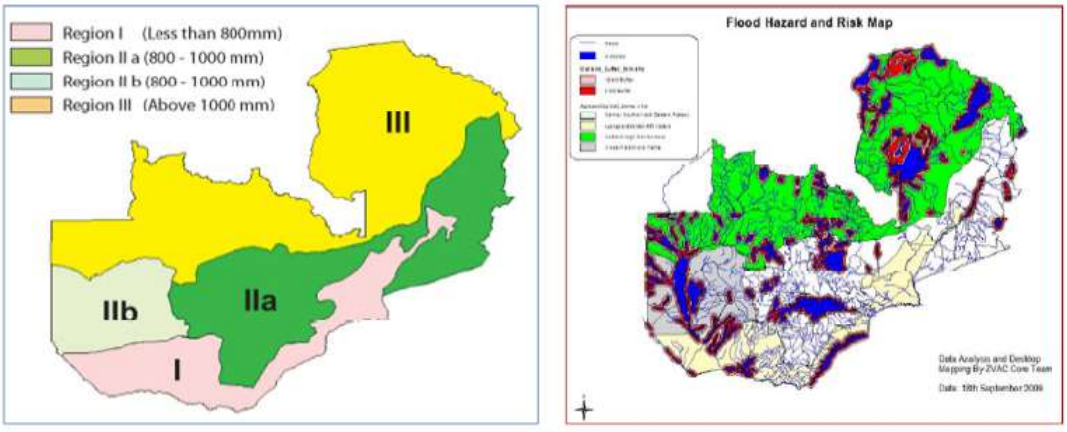
2. Development and Climate Risks

Current Climate Characteristics

5. Zambia's geographic location and topography gives the country a sub-tropical climate with three distinct seasons: the hot-dry season from mid-August to November (26-38° C); the rainy season from November to April (27-34°C) and the cool dry season from April to mid-August (13-26° C). Annual rainfall ranges from 600-1100 mm/year, and follows a north-south gradient, with an average of 700 mm/year in the south and 1,400 mm/year in the north. Rainfall in Zambia is also strongly influenced by the El Niño Southern Oscillation (ENSO), which brings drier than average conditions in the wet summer months in the south, whilst the north experiences wetter-than average conditions. The reverse occurs during La Niña episodes, with dry conditions in the north and wet conditions in the south. The influence of ENSO contributes to uncertainty in climate projections for this region. The rainy season is also affected by the Inter-Tropical Conversion Zone (ITCZ) which oscillates between the northern and southern tropics over the course of a year, bringing rain between November and April. Variability in the movement of the ITCZ leads to variability in the rainfall received from one year to the next.

6. Zambia is divided into three agro-ecological regions (Figure 4). Based on data from 1961-1990, Region I has the lowest rainfall (about 800 mm), followed by Region II and III. According to the National Adaptation Programme of Action (NAPA)[6], Region I has also consistently had the most droughts and water scarcity - and, along the Caprivi strip and Lake Kariba, regular floods. It is therefore considered to be the most vulnerable region in Zambia. Regions III, IIa and IIb are also exposed to floods, particularly around floodplains.

Figure 4. Agro-Ecological Zones in Zambia based on Rainfall Patterns, and Flood Risk Map



Sources: Zambia Meteorological Department (2004) and Disaster Management and Mitigation Unit (2009)

[6] MTENR. 2007. National Adaptation Programmeme for Action.

Climate Change and Variability

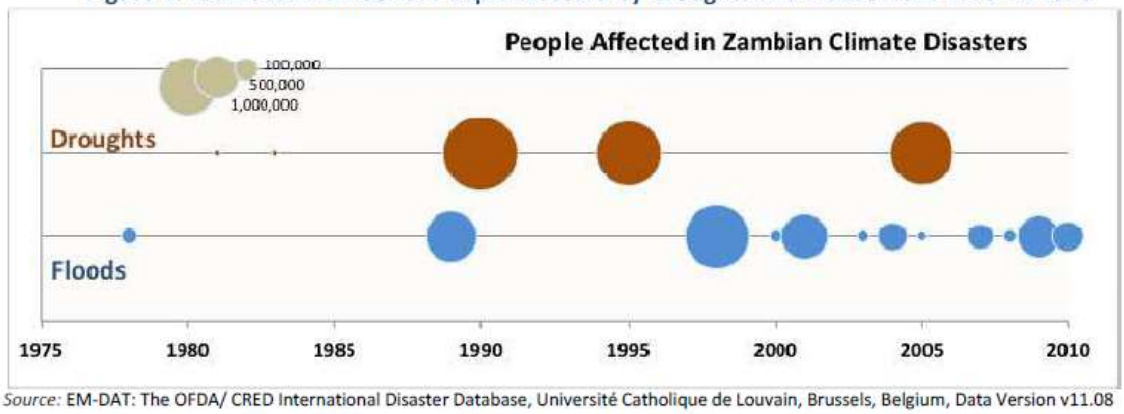
7. **Historical Trends.** Based on 1960-2003 records, Zambia has experienced the following trends[7]:

- Mean annual temperature has increased by 1.3° C since 1960, an average rate of 0.29^0 C per decade, with the rate of increase most pronounced during winter months (0.34^0 per decade).
- The number of hot days and hot nights per year has increased by 43 days, with the most pronounced increases between March-May (hot days) and December-February (hot nights).
- The average number of cold days and nights per year has decreased by 22 and 35 days, respectively. The decrease in cold days is similar across all seasons, while that of cold nights appears to be more pronounced between March-May.
- Mean rainfall has decreased by 1.9 mm/month (2.3% per decade), mainly due to decreases during peak months of the rainy season (December-February).

8. In sum, rainfall seasons in southern Zambia have become less predictable and shorter (most notably in the south-western area), with rainfall falling in fewer, more intense events.

9. From 2000 to 2007, the intensity and frequency of droughts and floods and the number of people affected has also changed, with a net trend towards more floods and, over a longer time-period, droughts (Figure 5). Floods have been occurring once every 2.3 years and droughts once every 5 years, intensifying to once every three years in recent years (1991-2011). Droughts have also been occurring within rainy seasons, such as in 2000/01, 2001/02, and 2004/05. Moreover, the area affected by floods and droughts appears to have expanded: the 2006/07 flood, for example, affected 41 districts in nine provinces, and the 2004/05 drought left nearly two thirds of Zambia with little or no rainfall.

Figure 5: Estimated Number of People Affected by Droughts and Floods from 1975 To 2010



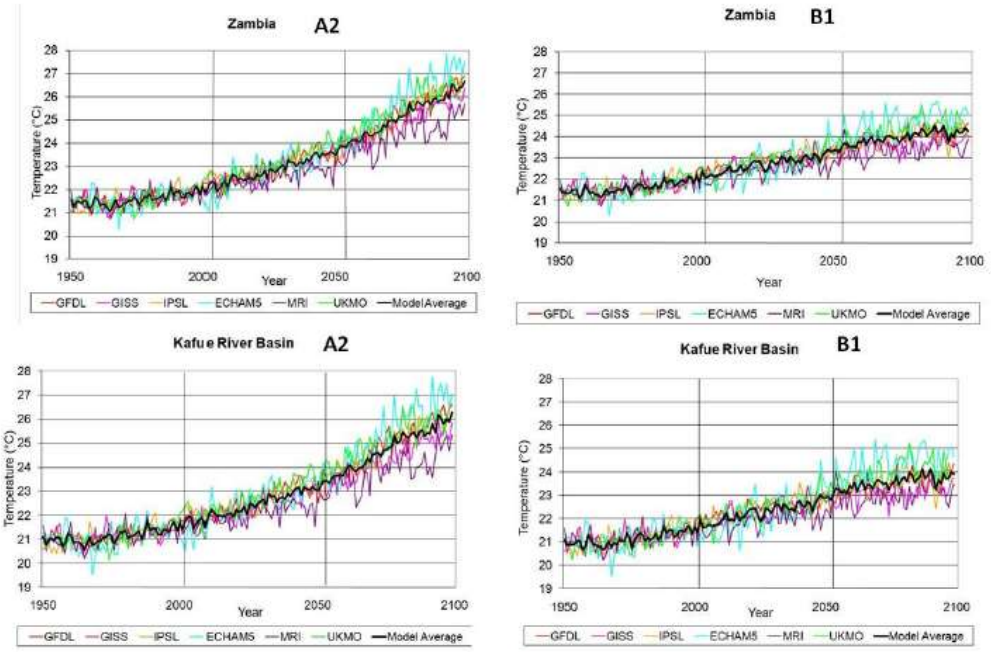
Source: EM-DAT: The OFDA/ CRED International Disaster Database, Université Catholique de Louvain, Brussels, Belgium, Data Version v11.08

[7] IPCC Fourth Assessment Report and UNDP Climate Profiles. Hot days and hot nights are defined as those when the temperature above which 10% of the days or nights are recorded in the current climate for that region and season. Conversely, cold days and cold nights are defined as the temperature below which 10% of days or nights are recorded.

10. **Projected Climate Change.** Future climate trends in Zambia have been documented in the NAPA, a World Bank-funded Water Sector study, and in a Climate Change Knowledge Portal[8]. However, these projections were at a relatively coarse spatial resolution. A recent IFC study[9] used downscaled climate data from six Global Circulation Models (GCMs) and two Special Report on Emissions Scenarios (SRES), A2 and B1. This yielded 12 different projections of temperature and precipitation for the period up to 2100, using 1960-1999 as a base. The results are as follows:

(a) **Temperature.** Projected increases in average annual temperature are 3-5^0 C for Zambia and 3-6°C for Kafue Basin by 2100 (Figure 6). By 2060, models indicate temperature increases of 1.2-3.4^o C, with the largest increase in the northern and eastern regions. By 2060, the number of hot days is nights are projected to increase significantly throughout the country, by 15-29% and 26-54%, respectively. Cold days and nights are projected to decrease significantly, to the extent of becoming rare and occurring no

Figure 6. Simulated Annual Times Series of Temperatures Spatially Averaged over Zambia (top figures) and Kafue River Basin for A2 (left) and B1 (right) Emission Scenarios



Source: IFC (2011). Kafue Gorge Lower Hydropower Project: Climate Change Risk Assessment

[8] World Bank Climate Change Knowledge Portal, MTENR (2007). See footnotes 7 and 10 for other references.

[9] IFC (2011). *Kafue Gorge Lower Hydropower Project: Climate Change Risk Assessment,* MTENR (2007). *Formulation of the National Adaptation Programmeme of Action on Climate Change*, and World Bank 2009. *Managing Zambia's Water for Sustainable Growth and Poverty Reduction. A Country Water Assistance Strategy for Zambia.*

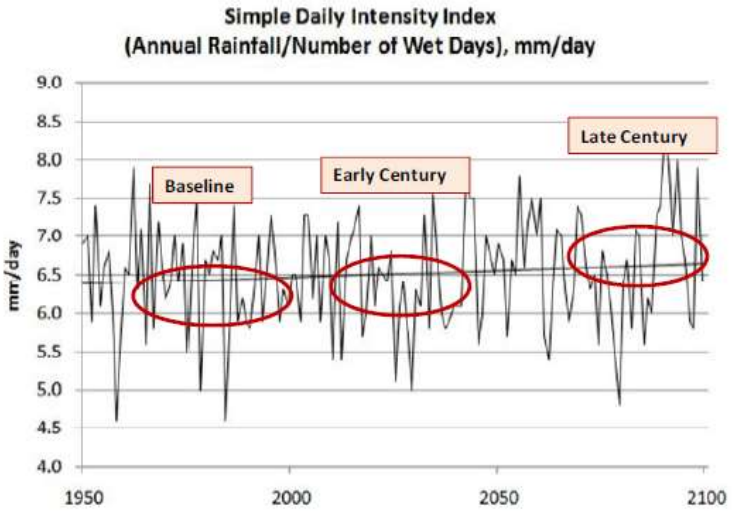
more than 1-4% per year (Figure 6). Further, by 2100, maximum temperatures are projected to exceed historical ranges for 8 months of the year. Temperature changes, combined with changes in precipitation variability, are likely to affect soil moisture and seasonal patterns of rainfall, thereby affecting agriculture and biodiversity.

(b) **Precipitation**. While average annual precipitation is not projected to change significantly – model results range from -3% to +3% by 2100 - precipitation variability is expected to increase. During the early rainy season (October-December), precipitation levels are projected to decline – equivalent to three months out of the 7-months rainy season becoming drier. By contrast, the proportion of rainfall resulting from heavy events is projected to increase, particularly during December to May. By 2100, the IFC study indicates maximum 1-day precipitation increases of over 275% for some scenarios. For Kafue, the net result is expected to result in a positive change (about +11%) in Kafue River flows.

Table 3: Comparison of Precipitation for Base and Late-Century Periods for ECHAM5 A2

	Daily Average (mm)		Annual Average (mm)	
Parameter	*Base Period*	*Late Century Period*	*Base Period*	*Late Century Period*
Minimum	19	13	619	848
Average	27	31	1,020	1,065
Maximum	46	56	1,233	1,341
St. Deviation	7.1	9.3	149	164

Figure 7. Projected Variation in Rainfall Intensity through ECHAM5 A2 Model



Source: IFC (2011). Kafue Gorge Lower Hydropower Project: Climate Change Risk Assessment
Notes: mm = millimeter. St. Deviation = standard deviation.

(c) Extreme Events. The projected changes in precipitation variability could lead to more intense floods and longer and more severe droughts. Simulated changes to the probability of exceeding flood thresholds – defined as a 15% deviation from normal rainfall for the rainy season – indicates that floods are expected to continue to occur frequently in the future, and, for models like ECHAM5 A2, increase in frequency (Table 4). Flood magnitude is also expected to increase due to more extreme precipitation and run-off. Thus, infrastructure build to withstand 100 or 1000-year maximum probable flows may need to be redesigned. It is also expected that droughts may occur more frequently, as simulated by several GCM scenarios (Table 5).

Table 4: Probabilities of Exceeding Seasonal Precipitation Flood Threshold (early, mid and late 21st Century)

GCM	Emissions Scenario A2			Emissions Scenario B1		
	Early Century (2010-2039)	Mid Century (2040-2069)	Late Century 2070-2099)	Early Century (2010-2039)	Mid Century (2040-2069)	Late Century (2070-2099)
ECHAM5	25%	35%	39%	29%	16%	23%
IPSL	21%	36%	16%	43%	26%	29%
MRI	22%	28%	18%	19%	14%	27%

Table 5: Projected Probability of Drought (early, mid and late 21st Century)

GCM	Emissions Scenario A2			Emissions Scenario B1		
	Early Century (2010-2039)	Mid Century (2040-2069)	Late Century 2070-2099)	Early Century (2010-2039)	Mid Century (2040-2069)	Late Century (2070-2099)
ECHAM5	13%	9%	10%	14%	19%	17%
IPSL	15%	14%	22%	5%	9%	10%
MRI	19%	13%	22%	21%	26%	13%

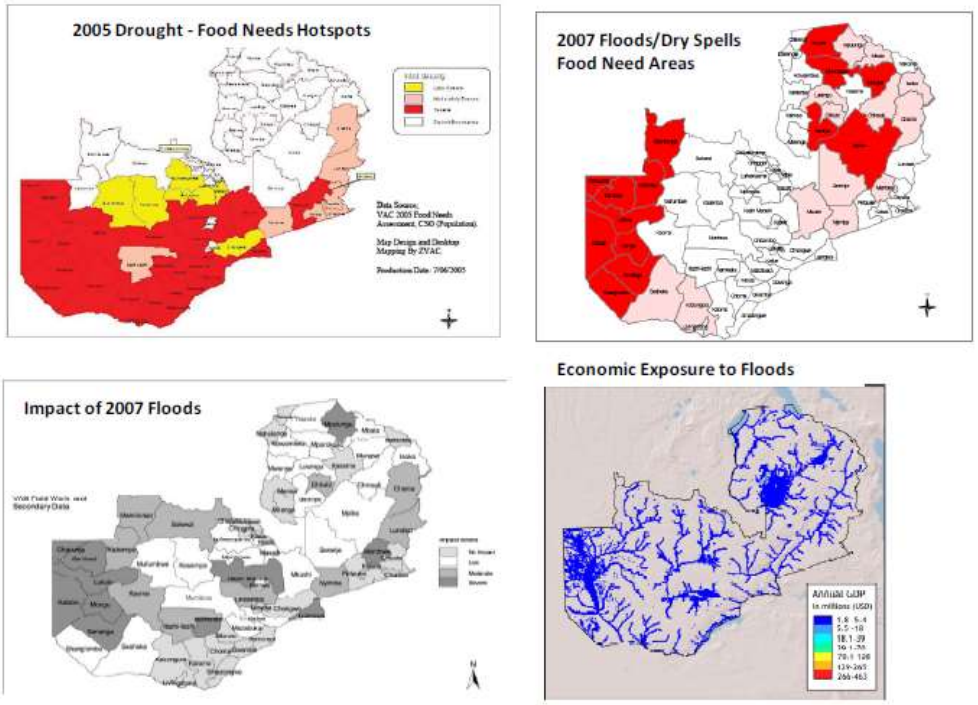
Source: IFC (2011). Kafue Gorge Lower Hydropower Project: Climate Change Risk Assessment

Vulnerability

11. **Economic Vulnerability.** Over the past three decades, floods and droughts have cost Zambia an estimated US$ 13.8 billion, or a loss of economic growth equivalent to 0.4% annually. In the future, in the absence of adaptation, rainfall variability alone could keep an additional 300,000 more Zambians below the poverty line and cost Zambia at least US$4.3 billion in lost GDP over the next decade, reducing future annual GDP growth by 0.9 percentage points.[10]

12. **Social Vulnerability.** Zambia's Vulnerability Assessment Committee (ZVAC), a consortium of Government agencies, NGOs and the UN, has carried out regular vulnerability assessments following major disasters since its establishment in 2002. The assessments have consistently shown the Western and Southern Provinces (and part of the Northern, Central and Western Provinces) as the most vulnerable (Figure 8). These are also the main focal areas for the PPCR.

Figure 8. Geographical Distribution of Drought and Flood Impacts



Sources: Zambia Vulnerability Assessment Committee Assessments (2006 and 2007) and World Bank (2011). Climate Resilience – Adaptation to Climate Change in Zambia (bottom right). Figure on bottom shows overall impact of 2007 floods on key sectors (housing, education disruptions, health, infrastructure, and crop losses)

[10] World Bank 2009. *Managing Zambia's Water for Sustainable Growth and Poverty Reduction. A Country Water Assistance Strategy for Zambia*, June 2009 and background papers. The analysis used 12 Global Circulation Models.

13. **Vulnerability to Droughts.** The 2005/06 drought left 1.2 million people - over 10% of the population - food insecure for up to 8 months. It affected 27 districts (37.5% of Zambia), seven of which severely. Most of the affected were subsistence farmers. As two-thirds of the households did not treat their water supply, water-borne diseases became a major concern.

14. **Vulnerability to Floods.** The 2007/08 flood displaced 495,972 people (8% of the population), 61% of whom in the Southern and Western Provinces. Some 445,000 people in 21 targeted districts required food assistance. Most of the affected (43%) were dependent on farming as their main source of livelihood, with the vast majority growing maize as the key food crop. The flood was also estimated to have damaged up to 66% of the transport infrastructure in the targeted districts (including culverts, bridges and roads). Some three-fourths of affected population claimed having received little or no warning, and of those who did, 66% did not heed the warnings.

15. **Impact on the Most Vulnerable.** The ZVAC 2005 assessments found that 55% of the population surveyed was poor. This is particularly the case in flood plains like the Zambezi. During floods, erratic and excessive rainfall along the Zambezi basin can lead to water logging, threatening the viability of the first season crop if it happens early during the planting season. As the second crop does not take place until 2-5 months later, climate change could increasingly affect the most vulnerable during the peak hunger months of September to February (Figure 9). Amongst the poorest households in the target areas of the SPCR, food sources are heavily reliant on subsistence agriculture and availability of food-for-work schemes, further compounding their exposure in cases of climate-induced crop failure (Figure 10).

16. Wealth is generally correlated with size of landholding and livestock, with the poorest generally relying on casual labour (mostly paid for in food), sales of vegetables, charcoal, wild foods, handicrafts, small livestock and gifts/remittances as their main source of cash income. Hence, a sudden increase in casual labour is usually one of the early signs of disasters. Amongst the households surveyed by the 2008 ZVAC, 22% were female-headed households, and amongst them, 51% were widowed and 21% were divorced or separated. The 2008 survey also found that 16% of the households were headed by the elderly, mostly widows. About 14% of the households took care of orphans, revealing the high prevalence of HIV/AIDS along river basins.

17. Overall, the most vulnerable groups in climate-sensitive districts are widowed female-headed households, the elderly, and single or divorced male-headed households. Women headed households are generally considered more vulnerable due to the fact that they take care of a higher number of dependents, and produce 25% less than male-headed households. The ZVACs found, in fact, that widowed, female-headed households were on average twice as vulnerable as male-headed households – although amongst single or divorced groups, male-headed households are generally more vulnerable than their female counterparts, and exhibit a higher degree of malnutrition.