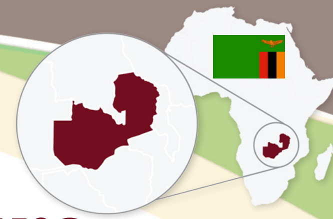


Climate-Smart Agriculture in Zambia

Climate-smart agriculture (CSA) considerations

A P

National food security in Zambia is reliant on a few staple crops, particularly maize. This crop is produced mostly by smallholders under rainfed conditions, which makes household and national food security vulnerable to weather variability and climate change related hazards such as temperature increases, changes in rainfall patterns and drought.

A M P

Conservation agriculture (CA) and agroforestry are the most widely promoted CSA practices in Zambia, with various impacts on livelihoods and the environment. Current efforts need to be expanded to incorporate CSA practices in crops, livestock and fisheries. Manure management, integrated soil fertility management (ISFM), pasture and forage management, fodder production, improved livestock housing and manure application all have potential to be well integrated into Zambia's production systems along with CA.

A M I

Cases of partial adoption and dis-adoption of some CSA practices, particularly conservation agriculture (95% dis-adoption rates in some locations), have been noted. There is need to analyse the drivers and barriers to sustained adoption, including access to CSA related inputs and outputs, capacity of the extension system on CSA and strengthening the methods of CSA promotion such as CSA-farmer field schools and lead farmer approaches.

M

Given the large contribution of savanna burning to Zambia's agricultural GHG emissions, improved savanna and grassland management, as well as fire management within crop production systems could play an important role in meeting the agricultural GHG emissions reduction targets outlined in the country's Nationally Determined Contribution (NDC).

A P

Tapping into Zambia's water resources and large irrigation potential for fruit and vegetable production could facilitate livelihood diversification, increase incomes and build resilience of smallholder farmers. This could be supported by the development and dissemination of low cost efficient irrigation systems (such as drip irrigation) and improved seed varieties as well as conducting of training on appropriate climate-smart vegetable production practices.

I $

The country has active private sector involvement in CSA related interventions in the form of organisations such as The Conservation Farming Unit (CFU) who have been promoting conservation agriculture and agroforestry. However, there is still need for a comprehensive private sector engagement strategy on CSA to facilitate private-public investments in technology development and dissemination, credit, and weather insurance for smallholders. Increasing awareness of the opportunities, costs and benefits of private investments in smallholder agriculture (de-risking the investment) could be an important step for public-private partnership on CSA.

A M P I

The establishment of the National Climate Change Fund (NCCF) and mainstreaming of CSA into national policies and strategies represent positive steps towards ensuring an enabling institutional and policy environment supportive of CSA. Improved technical and financial capacity of institutions and stakeholders to operationalize these policies and strategies through projects and programmes on the ground remain key for scaling out CSA.

I $

There is potential to access international financing for CSA, particularly through the Green Climate Fund (GCF) and the Adaptation Fund (AF) both of which the country has not yet accessed. The National Climate Change Fund (NCCF) that is currently under formulation could also play a key role in ensuring that national and international financing is directed towards identified CSA investments.

I $

Opportunities exist for women and youth to access funds related to CSA through mechanisms such as The National Youth Fund. However more needs to be done to address the underlying factors which hinder access of women, youth and vulnerable groups to agricultural finance such as land rights (both formal and customary), small land sizes and labour availability.

A Adaptation M Mitigation P Productivity I Institutions $ Finance

The climate-smart agriculture (CSA) concept reflects an ambition to improve the integration of agriculture development and climate responsiveness. It aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), and require planning to address trade-offs and synergies between these three pillars: productivity, adaptation, and mitigation [1]. The priorities of different countries and stakeholders are reflected to achieve more efficient, effective, and equitable food systems that address challenges in environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks [2]. Mainstreaming CSA requires critical stocktaking of ongoing and promising practices for the future, and of institutional and financial enablers for CSA adoption. This country profile provides a snapshot of a developing baseline created to initiate discussion, both within countries and globally, about entry points for investing in CSA at scale.

UKaid from the British people
WORLD BANK GROUP
CGIAR
RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security
CCAFS
CIAT 50 1967-2017

National context

Economic relevance of agriculture

Agriculture is an important sector in Zambia, contributing an average of 8.2% to the national Gross Domestic Product (GDP) over the period 2011-2015 [3][1]. Almost a half of the economically active population is employed in the agricultural sector, which also constitutes the main livelihoods source for an estimated 1.5 million households, representing 60% of all households in Zambia [4].

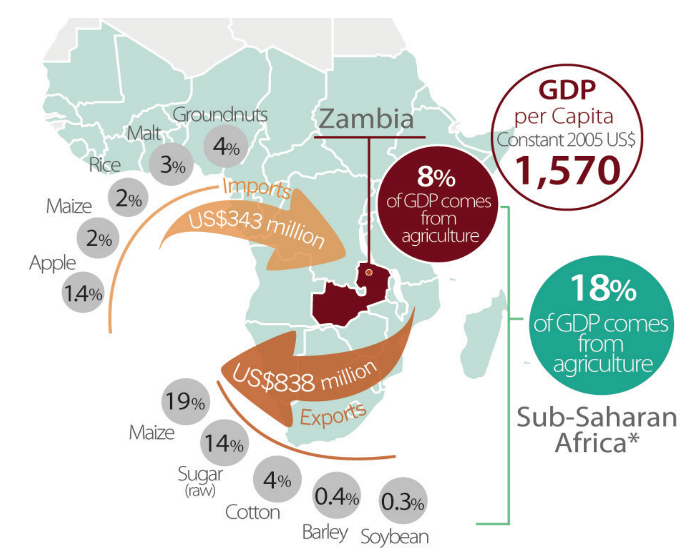
A large proportion of the agricultural export revenues, estimated annually at US$ 838 million, come from maize, sugar, and cotton [5]. Smallholder crop production is largely rainfed; hence, crop selection, planting time, use of input (timing and intensity) and labour, as well as yields are highly dependent on precipitation. Across the country, livestock constitute 20% of the household assets, and contribute 6% to smallholder household incomes and consumption [6].

The population of Zambia was estimated at 16.2 million in 2015 [3], 59% of whom live in rural areas. The rural dwellers depend largely on agriculture for food, nutrition, and incomes, and have a lower income level, compared to urban dwellers. Approximately 70% of agricultural labour is provided by women [4].

Approximately 1.6 million farmers in Zambia are small scale. They have been categorized into three groups, based on their farm size: category "A" farmers, with farm sizes of less than 2 ha and comprising 71.5% of smallholders; category "B", with farm sizes of 2-5 ha and comprising 23.8% of smallholders, and category "C" with farm sizes of 5-20 ha and comprising 4.7% of the smallholders. Medium scale farmers (with farm sizes of 20-100 ha) comprise about 400,000 farmers, while commercial farmers (with farmland over 100 ha) are estimated at approximately 740. Average arable land holding is estimated at 1.5 ha [8]. Zambia's annual maize[2] requirement for human consumption, industrial use, annual grain reserves and other needs has been estimated at 2.9 million tonnes [9].

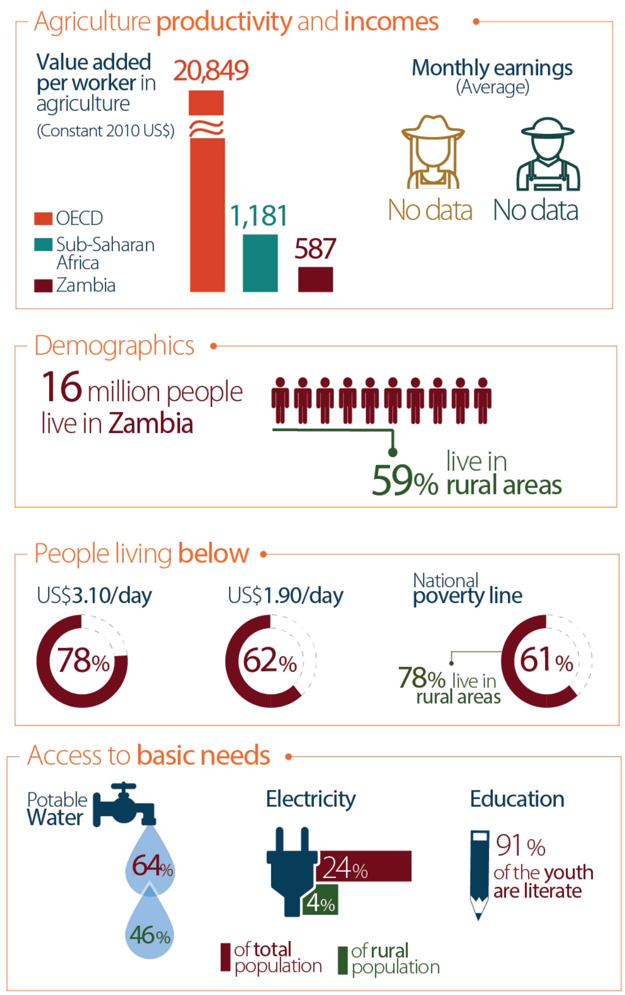
Approximately 61% of the population live below the poverty line and most of them are found in rural areas [10]. While access to basic needs (electricity, potable water) remains low, youth literacy rates have improved over the past years and are now estimated at 90%. The Zambian currency has remained relatively stable, however; inflation has been a concern[3] and has often resulted in increases in staple food prices.

Economic relevance of agriculture in Zambia [4, 5]



*Sub-Saharan Africa: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Brazzaville), Congo (Democratic Republic), Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Réunion, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Western Sahara, Zambia, Zimbabwe

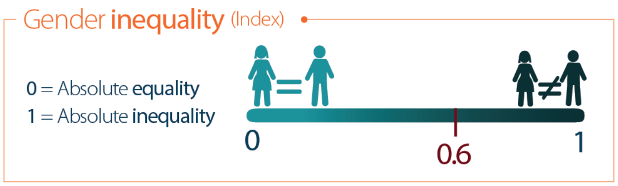
People, agriculture and livelihoods in Zambia [4, 5, 7]

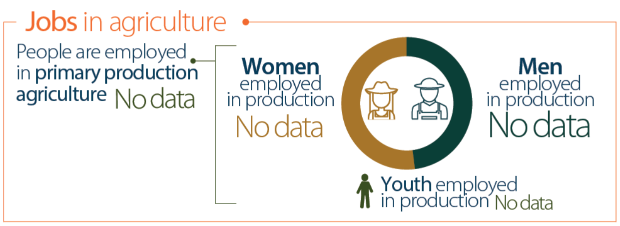


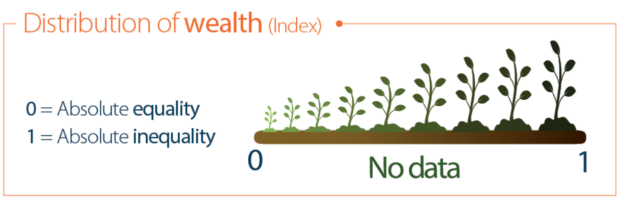
1 Mining is the biggest contributor to Zambia's economy and GDP.

2 Maize is the main food crop in the country

3 Inflation reached as high as 18.9% in September 2016







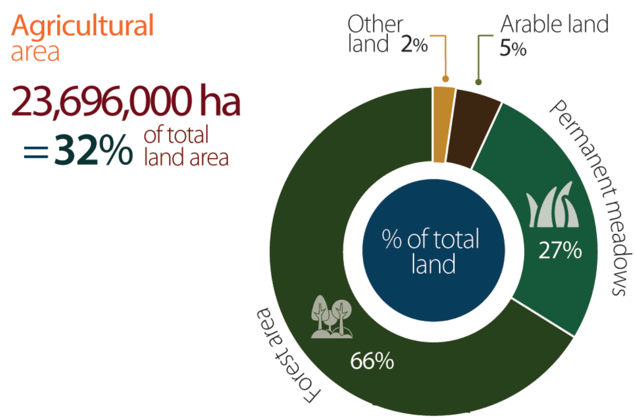
Land use

Zambia is a landlocked country, covering an area of about 752,614 square kilometres (km^2). Of the total land area, 42 million hectares (58%) are potentially suitable for agricultural production [11], yet only 15% of this potential land is cultivated [12]. Forests and woodland cover an additional 71% (the equivalent of 535,000 km^2) of Zambia's land[4] [12].

About 523,000 ha are irrigable, yet only 155,890 ha of these (29%) are equipped for irrigation. Overhead (sprinkler) irrigation on arable crops and sugar cane is mainly used for crop watering by commercial farmers. Localized systems such as drip irrigation (vegetables), micro-jets and bubblers (tree crops) are also common. Smallholders rely on a combination of buckets, watering cans, treadle pumps, and motorized pumps to water their crops [13].

Zambia has both indigenous forests and forest plantations with exotic trees like pine and eucalyptus. The Zambia Forestry and Forestry Industry Corporation Limited (ZAFFICO), a government parastatal, has more than 50,000 ha of forest plantations, while 7,000 ha are currently under other local supply plantations. Approximately 7.2 million ha of indigenous forests in 432 reserves are under government control [14]. However, some of these reserves have been de-gazetted[5] in recent years for human settlement, which also involved clearing of land for agriculture, charcoal production, and other livelihoods. Agriculture is one of the main drivers of deforestation, behind charcoal production, causing forest loses of 250,000-300,000 ha every year [12].

Land use in Zambia [5]



Agricultural production systems

Zambia can be classified into three main agro-ecological zones (AEZs): Region I (RI), Region II (RII) and Region III (RIII).

Region I, which covers Southern and parts of Eastern and Western provinces, is characterized by annual average rainfall of less than 800 mm and covers 12% of the total land area. The region's soils vary significantly, from largely loamy clayey soils in valleys, to shallow, fine, loamy soils on the plateau. Maize, sorghum, chickens, goats and sheep, cattle and pigs are predominant production systems. The region is also suitable for drought-tolerant crops like cotton, sorghum, and millet, and has good potential for irrigated crops, including fruits and vegetables. This AEZ is also suitable for extensive cattle ranching, except for areas where tsetse exists.

Region II is characterized by average annual rainfall of 800-1000 mm and covers 42% of Zambia's land area. RIIa covers Central, Lusaka and parts of Southern and Eastern provinces, where crops such as maize, cotton, tobacco, sunflower, soybean, irrigated wheat, and groundnuts predominate. The region is also suitable for the production of various vegetables. RIIb covers parts of the Western province and is characterized by sandy soils and the production of cashew nuts, rice, cassava and millet. The region is also suitable for cattle (beef and dairy) and poultry production.

Region III receives, on average, more than 1000 mm of rainfall a year, and covers 46% of the country's land area (mostly in the Copperbelt, Luapula, Northern and Northwestern Provinces). Soils in this region are highly leached and acidic[6], though there is high potential for

4 However, FAO reports 66% of the land area covered by forests [5].

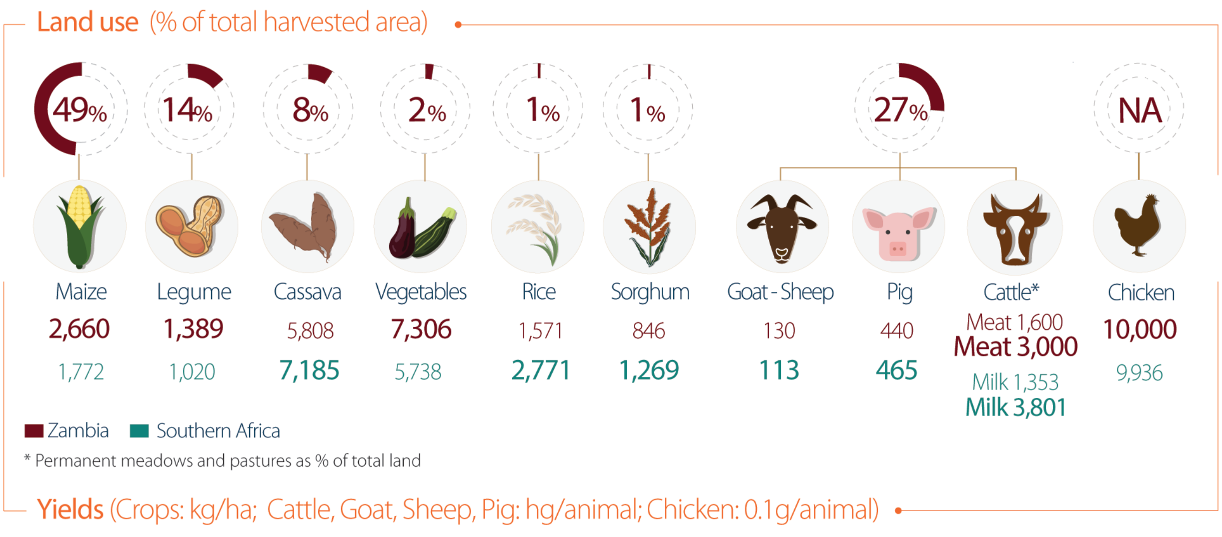
5 They have had their official forest status removed

6 partly due to use of unsustainable farming practices and use of blanket fertiliser recommendations)

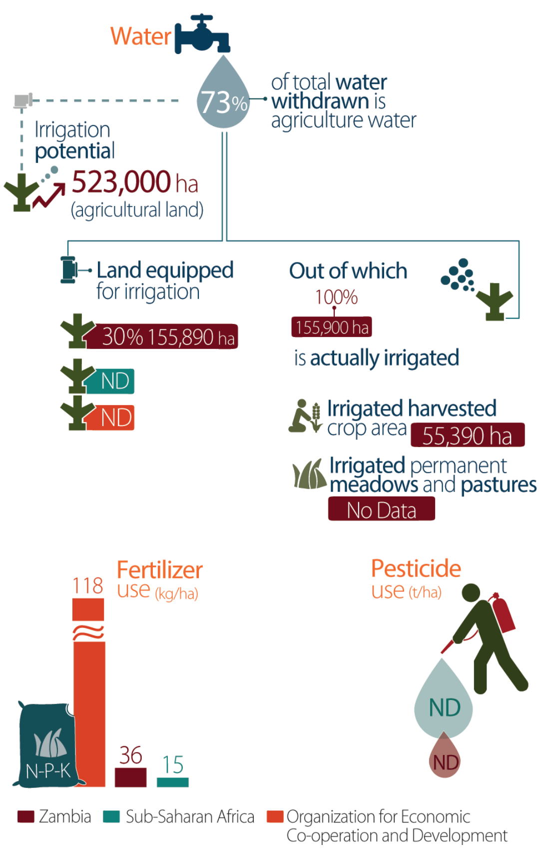
irrigation and fisheries while soil health can be improved through integrated soil fertility management (ISFM) informed by soil testing and subsequent fertilizer blending recommendatios. Maize, millet, cassava, sorghum, beans and groundnuts represent the main food crops while coffee, sugar cane, rice and pineapples are predominantly grown for sale.

Production across all regions is largely rainfed and productivity has been relatively low compared to other countries in the region. In addition, between 35 and 50% of the small-scale farmers keep between one and three livestock (cattle, goats, pigs and/or sheep). Only chickens are normally kept in greater numbers [6]. Among small-scale farmers, supplementary livestock feeding is practiced using forage species such as *Leucaena leucocephala, Acacia albida, Cassia siamea* and *Gliricidia sepium*. Recently, *Moringa oleifera*[7] has been added as a forage source for livestock.

Production Systems Key for Food Security in Zambia (5)



Agriculture input use in Zambia (4,5)



The following infographic shows a selection of agricultural production systems considered key for food security in Zambia. The selection is based on the production system's contribution to economic, productivity and nutrition quality indicators. For more information on the methodology for the production system selection, consult Annex 1.

Food security and nutrition

Zambia is fairly stable in terms of national food security status, particularly in reference to availability and access to staple grains such as maize. The country has experienced bumper harvest of maize over the past five years, being a net exporter of maize to neighboring countries. Moreover, Zambia sells the maize surplus to organizations who buy the grain to support their emergency food assistance programs in sub-Saharan Africa, such as the World Food Programme (WFP).

However, there are still geographical and socioeconomic pockets of people who suffer from food insecurity and malnutrition. Nearly half of the population (48.9%) is undernourished, while 15% and 6% of children under age of five are underweight and stunted, respectively [4].

Food insecurity remains particularly high in southern parts of the country, which have been affected by prolonged droughts and poor agricultural production in 2016. Other

7 *Moringa Oleifera* has multiple benefits for both humans and livestock. It serves as medicine, can be used for soap production, as well as livestock fodder production, water filtration, and biogas production.

factors contributing to food insecurity include price volatility (driven by inflation) and input and output markets. HIV/AIDS prevalence also contributes to a reduction in household productivity and income [15].

Food security, nutrition and health in Zambia[4, 5, 15, 16]

Food security

Score 0-100*

Global** 56

Zambia 37

Sub-Saharan Africa 36

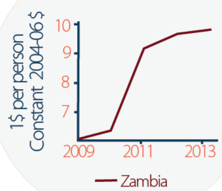
1 of 2 people is undernourished

* Takes into account aspects of affordability, availability, and quality

** Refers to the 113 countries included in the Index

Food security indicators (selection)

Stability



Per capita food production variability

Availability

1,908 Livestock products

1,908 Crop products

Calories available (kcal/capita/day)

Utilization

15% of children are underweight

6% of children are wasted

Access

ND of household budget is spent on food

ND of total roads are paved

Food aid (2012)

3,884 metric tons (cereals 79%)

Emergency 834 mt

Project aid 3,049 mt

Programme aid No data

Changes in total food aid (from 2012 to 2011) -51%

Health

Access to clean energy sources

17% of the population has access to clean energy sources (non-solid fuels) for cooking

Child Mortality rate

Under-five mortality rate (per 1,000 live births): 71

Adolescent fertility rate

98 births per 1,000 women, ages 15-19

Prevalence of HIV infections

13% people infected with HIV

57% are women (age 15+)

Agricultural greenhouse gas emissions

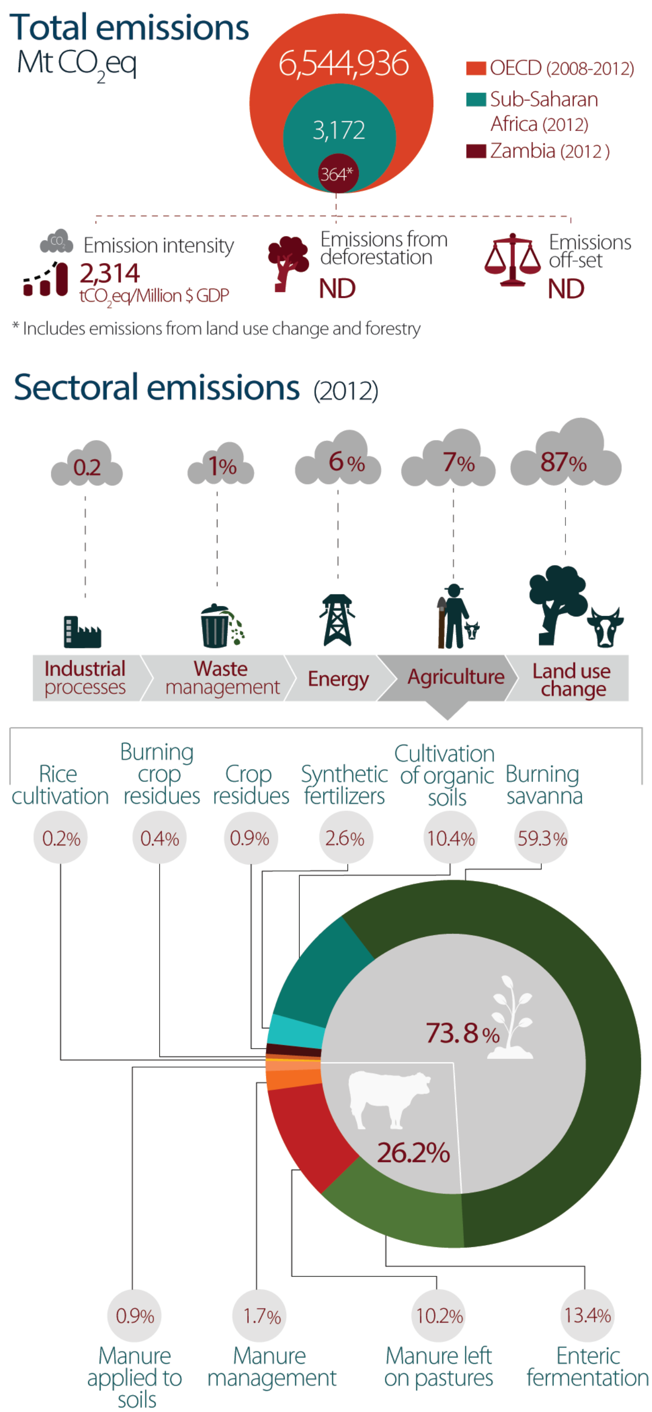
Agricultural greenhouse gas emissions make up 6% (23.1 $MtCO_2eq$) of Zambia's total annual emissions, estimated at 364.17 $MtCO_2eq$ in 2012 [17]. The greatest sectoral GHG emitter was the land use, land use change and forestry (LULUCF) sector (accounting for 86.6% of total emissions), while agriculture and energy were responsible for 6% and 6.5% of total emissions, respectively. The crops and livestock sub-sectors are responsible for 73.8% and 26.2% of agricultural GHG emissions, respectively. This contrasts to emissions patterns in countries in eastern and western Africa where livestock production is the main agricultural greenhouse gas emitter [5].

With its vast natural grasslands, a large component of agricultural GHG emissions in Zambia are associated with burning of savanna (59.4%), followed by enteric fermentation from livestock production (13.4%), cultivation of organic soils (10.4%) and manure left on pastures (10.2%) [5]. Savanna and grassland management (including fire management, shifting from slash and burn cultivation practice, and encroachment) could play an important role in Zambia's GHG emissions reductions targets, as pointed out in expert discussions[8]. Various agriculture- and forestry-related climate change mitigation programmes are already reflected in Zambia's Nationally Determined Contribution (NDC)[9], the Nationally Appropriate Mitigation Actions (NAMA) and communications to the United Nations Framework Convention on Climate Change (UNFCCC) and these are discussed in the policies section.

8 Expert discussions are held as part of the methodology of the CSA profile development process.

9 Agroforestry, conservation agriculture, biogas and fire management are mentioned as key strategies

Greenhouse gas emissions in Zambia



Challenges for the agricultural sector

Despite its importance to livelihoods and food security of the population, the agriculture sector plays a secondary role to the country's economic development agenda[10], after mining. For ensuring equitable growth and addressing current poverty, food and nutrition security challenges, incentivizing smallholder agriculture through policy and programme support is essential.

Agricultural credit, particularly for investments in climate change adaptation and mitigation measures that take up to 3-5 years to yield results, remains a challenge for small-scale farmers in Zambia. Only 2% of smallholders have formal title to their farms[11] [18], which makes access to long-term credit very difficult. When credit is available, interest rates are high due to the perceived risk associated with smallholder, rainfed agriculture.

While there are various stakeholders involved in agricultural extension provision (including government, NGOs, private sector), efforts are embedded in a project-based, rather than a programmatic approach, yielding fragmented and uncoordinated results. In recent years, collaboration among development partners on agricultural climate change adaptation and mitigation initiatives has improved, yet there is room for further information and experience sharing and joint programming.

Post-harvest grain losses have sometimes been as high as 35% at some national grain storage facilities. In general, losses occur due to high humidity, pest attack and pilfering. Region II and III have sporadic rains that sometimes result in grain losses in storage sheds and open-storage platforms. For vegetables, post-harvest losses are estimated at up to 50%, due to lack of post-harvest processing and storage facilities , and lack of market incentives for the smallholders. [19].

The agriculture sector also faces significant challenges related to inadequate access to agro-meteorological information, limited equipment availability (for example direct seeders and rippers), low adoption rates for some CSA practices[12], and poor farmer organization, among others. While there is considerable research available on conservation agriculture, further evidence on the implementation and impact of other CSA practices and technologies is needed to ensure appropriateness of practices in the country's different agro-ecologies and socio-economic contexts.

10 This includes contribution to national GDP and export revenues.

11 Zambia's Lands Act provides support for women who hold statutory land, but the law does not apply to customary land. Most land is held under custom and most customary tenure systems do not provide women with significant land rights — even when they do, traditional institutions often do not effectively implement the rules

12 Likely as a result of underlying factors related to the social, economic and technical suitability of the promoted practices.

The high reliance on maize as a food security crop[13] largely discourages farmers from diversifying their production system. As a result, even where intercropping and crop rotations are promoted, the focus and priority of farmers is largely on maize. There is need to develop input and output market systems for a range of agricultural commodities within diverse and climate-smart production systems.

Livestock production is generally affected by low productivity[14], low species diversification, poor grassland and rangeland management, low access to markets, disease prevalence[15], poor management practices (poor quality feed, poor housing), and inadequate veterinary services. While potential for fisheries exist[16], these are subject to rainfall- and temperature-induced changes in fish stocks.

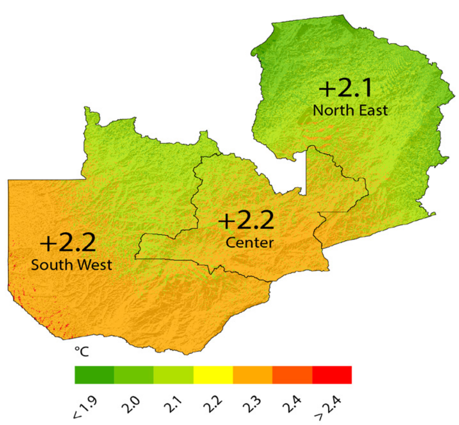
An additional major challenge is the country's heavy reliance on highly variable rainfall for crop and livestock production, which places a high risk and vulnerability to Zambia's agricultural production systems and hence the livelihoods and food security of the people who rely on them.

Agriculture and climate change

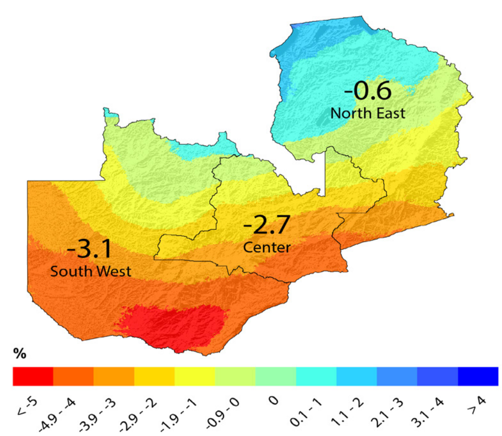
The combination of high food insecurity, relatively low yields, high deforestation rates and localized land degradation leave Zambia particularly vulnerable to climate change [20]. The country is already experiencing weather variability and climate change-induced hazards, including drought and dry spells, seasonal and flash floods, extreme temperatures and changes in season onset and cessation. Some of these hazards, such as droughts and floods, have increased in frequency and intensity over the past few decades and have adversely impacted food and water security, water quality, energy and livelihoods of the people, especially in rural communities. Zambia's INDC indicates that climate variability and change have become a major threat to sustainable development in the country [21]. It further indicates a number of specific impacts which are described below.

Projected change in Temperature and Precipitation in Zambia by 2050 [22, 23, 24]

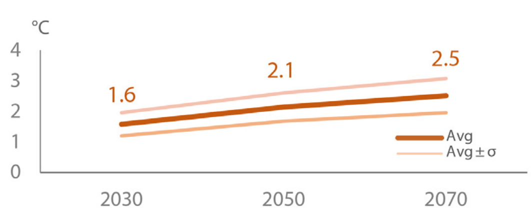
Changes in annual mean temperature (°C)



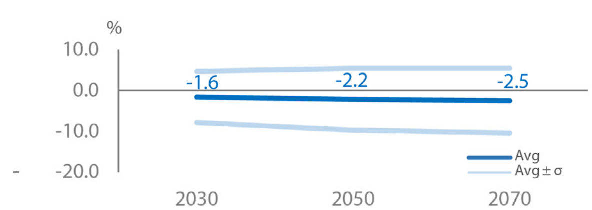
Changes in total precipitation (%)



Average temperature (°C)



Average precipitation (%)



13 Maize is the preferred staple food crop and currently covers about 50% of the total cultivated area annually.

14 Mainly linked with low genetic potential and poor animal health management.

15 Diseases such as Tryposomiasis, East Coast Fever, bovine pleural pneumonia, lumpy skin disease.

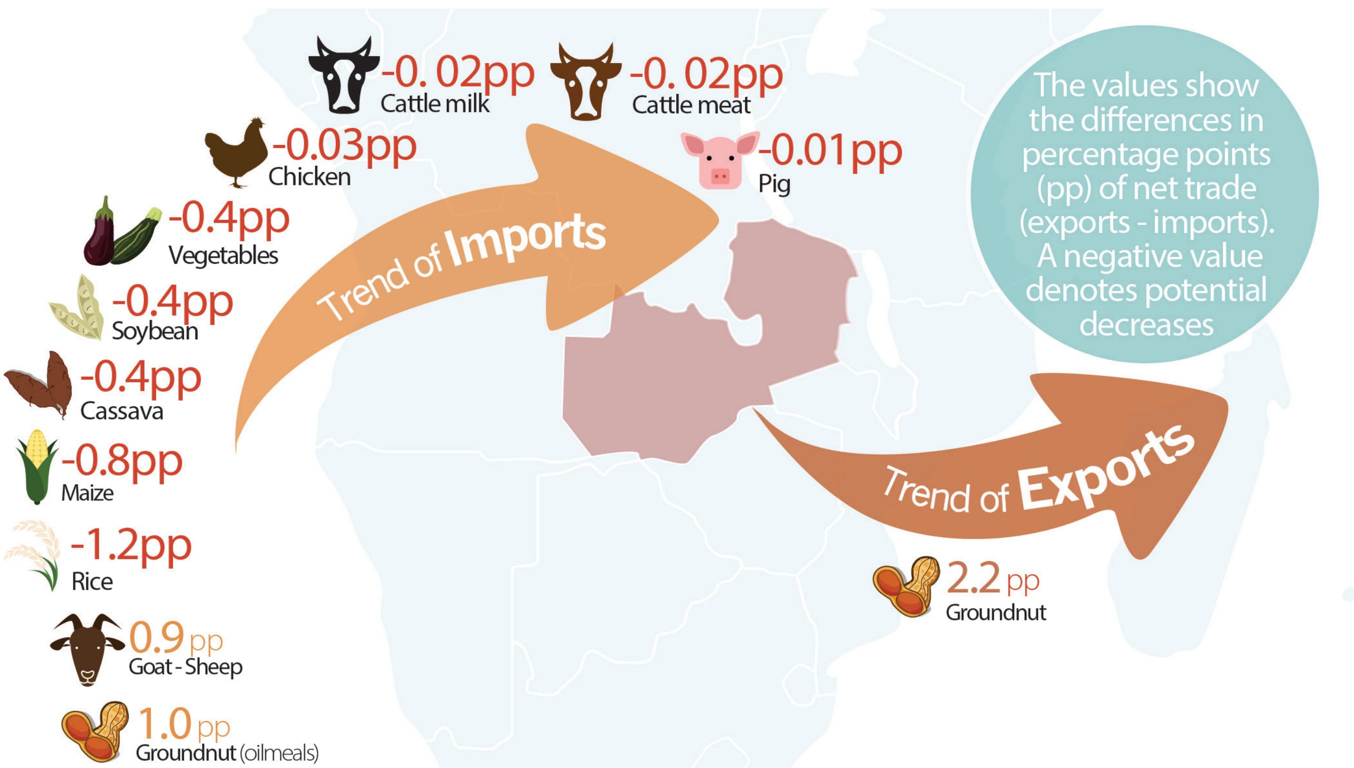
16 There are nine (9) major capture fishery areas in Zambia namely: Lake Tanganyika, Lake Mweru-Luapula, Lake Bangweulu, Lukanga swamps, Upper Zambezi, Lake Kariba, Lower Zambezi, Lake Itezhi-tezhi and Kafue Floodplain fisheries

Climate trends based on 1960-2003 records indicate that mean annual temperature has increased by 1.3°C since 1960, an average of 0.34°C per decade. Moreover, mean rainfall has decreased by an average of 1.9 mm/month (2.3%) per decade since 1960.

Further analyses indicate that by 2050, Zambia is expected to experience increases in temperature of up to 2.2°C with the greatest increases expected in the southern parts of the country. On the other hand, rainfall is expected to increase by up to 4% in the northern parts of the country, but may reduce by as much as 5% in the southern parts of the country [22, 23, 24]. The country, therefore; has to plan for different climate change scenarios, particularly in the agriculture sector where these changes are expected to have the greatest impacts. For example, climate change related losses in agriculture are expected to amount to US$ 2,200–3,130 million over the next 10-20 years. Increases in rainfall may result in waterlogged agricultural fields, destruction of crops (in both pre- and post-harvest), contaminated water supplies and increases in incidence of crop and livestock disease. Reductions in rainfall are likely to reduce water availability for both crops and livestock and also affect the quantity and quality of pastures. In places where rainfall quantity does not change significantly, there may still be changes in season onset and cessation that could negatively affect the production of key crops, including maize, cassava and millet.

Potential economic impacts of climate change

The impact of climate change on net trade in Zambia (2020-2050)



The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) was used to further analyse the effects of climate change on agriculture in Zambia over the period 2020-2050[17] [25]. This assessment took into account three parameters, namely net trade, crop area (or livestock numbers), and yields, for scenarios with and without climate change (CC and NoCC)[18].

Results suggest that Zambia may become more dependent on imports of major agricultural commodities, with the exception of cotton and groundnut, whose exports are expected to increase in the period up to 2050. Exports are expected to be lower and imports higher for almost all crops under the climate change scenario than under the no climate change scenario.

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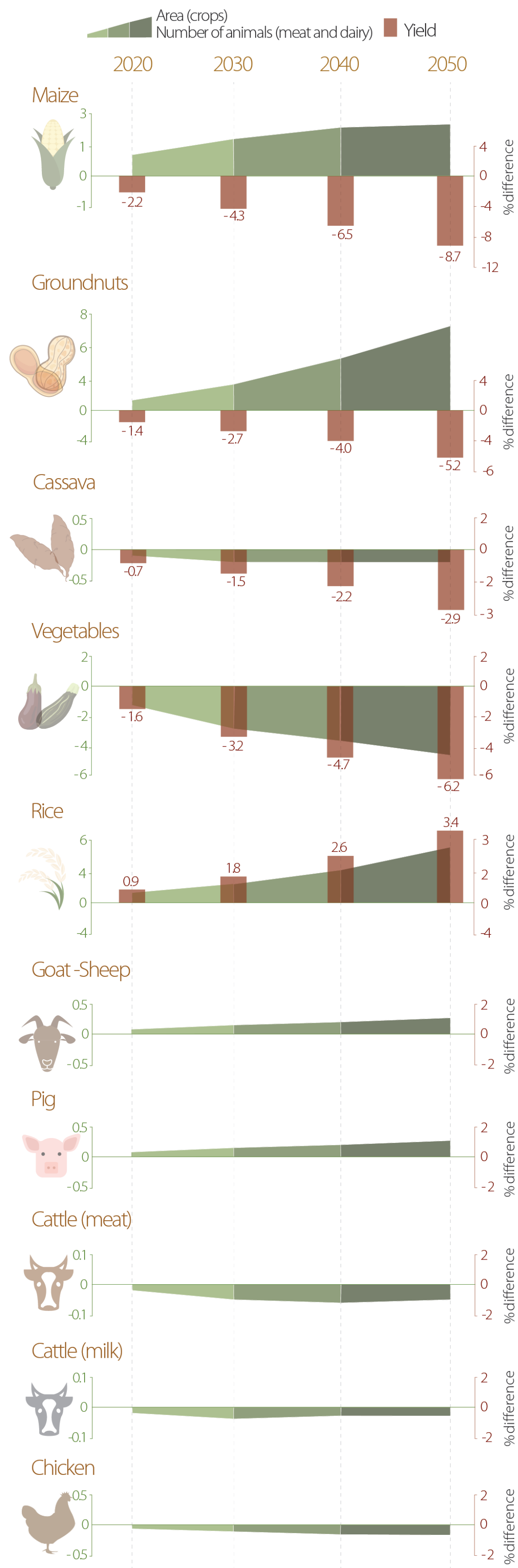
17 The IMPACT Model was parameterized by the Second Shared Socioeconomic Pathway (SSP2), a conservative scenario that is typically considered "business-as-usual".

18 For the analysis, some crops identified as being important for Zambia were assessed individually; cassava and sunflower were assessed under the category of tubers and oil crops, respectively, due to unavailability of disaggregate data. An analysis for fish was not possible owing to the nature of the production system and also unavailability of information.

Climate change impacts on yield, crop area and livestock numbers in Zambia



*A negative value denotes potential decreases in area and yield expressed as percentage change in a climate change scenario vs. non climate change

The impact of climate change on area cultivated by 2050 is heterogeneous:

- The area under potato cultivation is projected to decrease under both scenarios; however, the decrease under climate change is expected to be greater by 11.9% than that under the no climate change scenario.
- The areas under cassava, cotton and vegetable cultivation are projected to increase under both scenarios; this increase is expected to be less under climate change by 0.2pp, 1.7pp, and 4.5pp, respectively.
- On the contrary, the land areas cultivated with groundnut, maize, and rice are likely to be less under climate change by 7.3pp, 2.4pp and 5.7pp, respectively, as compared to the no climate change scenario.

In terms of crop yields, key results indicate that by 2050 the following could occur:

- Yield for some crops are projected to grow over the period 2020 to 2050 under both scenarios, yet, the increase is expected to be less under climate change. In particular, with climate change, cassava, cotton, groundnut, maize, soybean, and vegetable yields are projected to be less by 2.9pp, 6.5pp, 5.2pp, 8.7pp, 3.0pp and 6.2pp.
- Potato yields are projected to decrease under both the climate change and no climate change scenarios; however, the decrease is expected to be 26.4pp more under the climate change scenario.
- Rice yields are projected to be 3.4pp higher under the climate change scenario compared to the no climate change scenario.

The impact of climate change on animal numbers is anticipated to vary with animal type, but are not expected to be significantly different under both the climate change and no climate change scenarios. Poultry and lamb production are projected to be less by 0.17% and 0.28% under climate change, compared to a no climate change scenario. Pig production is projected to increase by 0.26% under the climate change scenario. Projections indicate that cattle and milk production will not be substantially affected.

All production systems in Zambia are projected to be at least somewhat adversely affected by climate change.

CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges, as well as for economic growth and development of the agriculture sector. For this profile, practices are considered CSA if they enhance food security as well as at least one of the other objectives of CSA (adaptation and/or mitigation). Hundreds of technologies and approaches around the world fall under the heading of CSA.

With its three main principles of minimum soil disturbance, crop rotations and associations, and permanent soil cover, conservation agriculture (CA) has been one of the most advocated CSA practice in the country, especially in Region I and II of the country. Farmers accessing the government-supported Farmer Input Support Program (FISP) are required to practice conservation farming as a prerequisite for access to inputs; enforcement of this measure is, however, weak. While Zambia has been considered a leader in promoting CA in Sub-Saharan Africa, adoption of the practice by smallholders has been generally low and characterized by partial adoption [26]; as well as high dis-adoption rates of up to 95% of farmers in some locations [27]. The use of low and laborious technologies (such as hand hoes), limited availability of labour-saving equipment (jab planters, direct seeders and rippers), and limited knowledge and capacity of farmers to maintain the practices after initial support, are some of the drivers of low adoption and high dis-adoption rates. Additionally, farmers usually have to wait for multiple seasons to reap the benefits of the practice, and in some land holdings, crop residues are valued more for animal feed rather than for soil cover, making the investment less attractive to smallholders.

Agroforestry has also been promoted across the country, especially through Faidherbia albida (also known as Musangu), given its nitrogen-fixing properties. Adoption rates have been typically low, due to high costs and low availability of seedlings and the time taken to reach maturity (7 years on average). Exploration of the use of fast-growing fruit and fertilizer trees for agroforestry could support higher adoption rates. Agroforestry is a key practice within REDD+ for which Zambia was one of the 14 initial UN-REDD[19] pilot countries.

Farmers in Zambia also practice organic farming in maize cultivation and use drought-resistant varieties of sorghum, and maize among others. Integrated pest and disease management (IPDM) for both crop production and livestock production (chicken, livestock) is also an important practice.

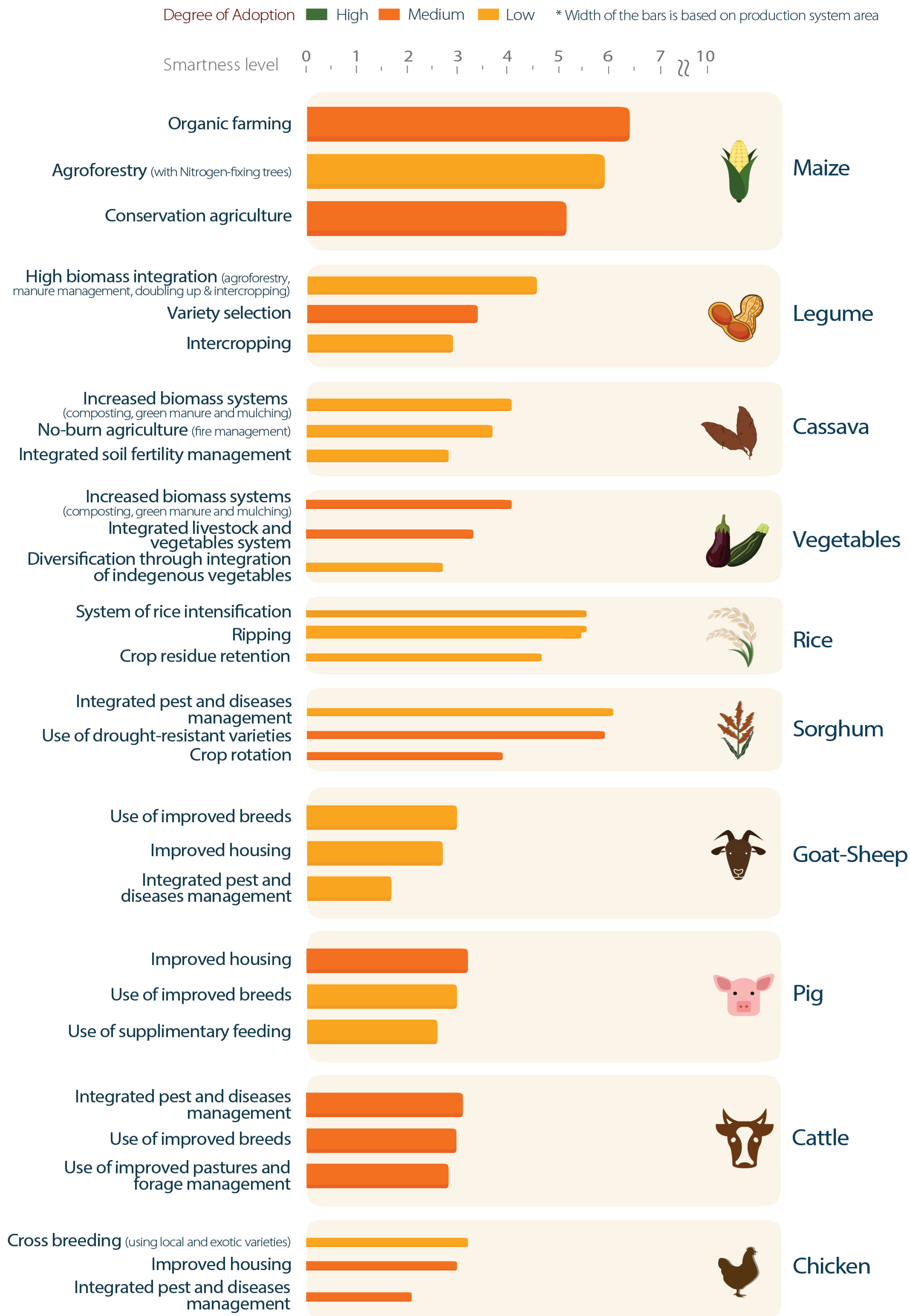
CSA practices for livestock are mainly focused on manure, pasture, grazing and forage management; livestock integration into cropping systems; integration of agroforestry into crop-livestock production systems; and improved housing and feeding practices.

Off-farm practices related to the use of climate information and early warning in seasonal and longer term agricultural planning exist as means of improving and adapting local agricultural decision making.

The following graphics present a selection of CSA practices with high climate-smartness scores according to expert evaluations. The average climate smartness score is calculated based on the practice's individual scores on eight climate smartness dimensions that relate to the CSA pillars: yield (productivity); income, water, soil, risks (adaptation); energy, carbon and nitrogen (mitigation). A practice can have a negative, positive or zero impact on a selected CSA indicator, with ±10 indicating a 10 0% change (positive/negative) and 0 indicating no change. Practices in the graphics have been selected for each production system key for food security identified in the study. A detailed explanation of the methodology can be found in Annex 2.

19 UN-REDD focused on supporting countries with national REDD+ readiness efforts

Selected CSA practices and technologies for production systems key for food security in Zambia



Case study: Integrated crop-livestock systems for climate-smart agriculture

Households and communities in Southern, Eastern and Central Provinces of Zambia have been implementing a landscape approach to CSA. With the technical support of Grassroots Trust, a local organization, farmers have learned and piloted an integrated farming system based on four principles: holistic management, planned grazing, low-input (regenerative) cropping, and agroforestry/ farmer-managed natural regeneration (FMNR). The system involves practices such as mixed cropping (rotations and intercropping), pen-reared livestock combined with the collection and use of livestock manure, integration of legumes and nitrogen-fixing trees in and around crop fields, and controlled grazing.

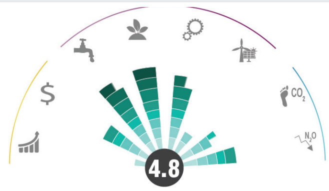
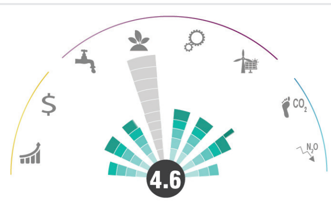
Each of the four principles has specific social, economic, and environmental benefits. Holistic management is a framework developed to take into account social, environmental, and economic factors for inclusive decision-making. Holistic planned grazing relies largely on promotion of grazing patterns that are timed to reduce overgrazing and improve pasture and ecosystems and to reduce recycling of ticks and parasites. Low-input (regenerative) cropping enhances natural water cycles and nutrient flows to increase profitability and sustainability. FMNR allows trees to regenerate from stumps and bushes through the removal of excess shoots and suckers. When combined, the four approaches help increase soil organic content, enhance soil fertility, improve animal health, enhance water and nutrient cycling, and ultimately improve productivity of crops and livestock, while regenerating and building agroecosystem's resilience to climatic shocks.

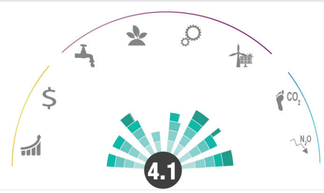
In practice, farmers are encouraged to plant and take care of Faidherbia Albida (Musangu) trees. They also rotate their maize with groundnuts or sugar beans to help sequester carbon and fix nutrients back into the soil. Fields are prepared well before the rains - between June and August - and treated with on-farm manure collected every day and covered under a tarpaulin. Planting is done with the first heavy rains. Additionally, farmers also receive training on supplementary feeding of the livestock.

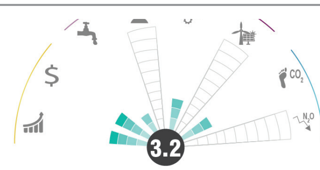
On a demonstration farm in Kafue Town, 35 km from Lusaka, farmers claimed a twofold increase in average maize yields, as a result of implementing this holistic approach to farming. The diverse nature of the system is expected to increase resilience to droughts and dry spells, while improving incomes of farming households and communities. Impacts of such interventions on mitigation have yet to be quantified; however, it is expected that the principles related to agroforestry, manure management, soil management, as well as the low-input nature of the system are likely to contribute to a reduction in GHG emissions from the farming system.

Case study and photos courtesy of Grassroots Trust http://grassrootstrust.com/

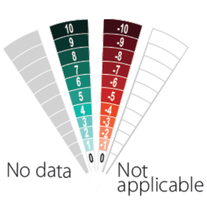
Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in Zambia.

CSA practice	Region and adoption rate (%) <30 / 30-60 / 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Maize (49% of total harvested area)				
Conservation Agriculture	Natural Region 2a <30%	S M		**Productivity** Increases soil moisture due to the mulch layer and conservation of soil structure. Reduces soil erosion. **Adaptation** Higher profits due to increased crop yields and reduced production costs. **Mitigation** Mulching and cover crops increase soil organic matter and carbon stocks. Reduces fuel requirements for tillage.
	Natural Region 1 <30%	S		
Agroforestry (with Nitrogen-fixing trees)	Natural Region 2a <30%	S		**Productivity** Can improve soil fertility, support mulching, provide fodder for animals and ultimately improve crop and livestock yields. **Adaptation** The inclusion of trees in fields can provide shade and reduce oil temeperetaure and help conserve soil moisture. **Mitigation** Increases in carbon capture and storage.
	Natural Region 1 <30%	S		
Legumes (groundnut, beans, soyabean, cowpeas) (14% of total harvested area)				
High biomass integration (Agroforestry, manure management, doubling up& intercropping)	Natural Region 1 <30%	S		**Productivity** Enhances production per unit area. Diversifies income and food sources. **Adaptation** Contributes to spread crop failure risk, improves soil water retention. **Mitigation** Improves above and below ground carbon stock and organic matter. Reduces the need for synthetic fertilizers.
	Natural Region 2a <30%	S M		
Variety selection	Natural Region 1 30-60%	S		**Productivity** Increases productivity per unit area. Contributes to reductions in production costs. **Adaptation** Enables production and yield stability even when there is water scarcity. **Mitigation** Helps maintain a above- and below-ground biomass even in dry periods.

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Legumes (groundnut, beans, soyabean, cowpeas) (14% of total harvested area)				
Variety selection	Natural Region 2a <30%	S		**Productivity** Increases productivity per unit area. Contributes to reductions in production costs. **Adaptation** Enables production and yield stability even when there is water scarcity. **Mitigation** Helps maintain above- and below-ground biomass even in dry periods.
Cassava (8% of total harvested area)				
Increased biomass systems (composting, green manure and mulching)	Natural Region 1 30-60%	S		**Productivity** Improved soil fertility and structure resulting in increased yields. **Adaptation** Improved water retention in soils. **Mitigation** Reduces requirement of synthetic fertilizers, hence reducing nitrous oxide emissions.
	Natural Region 2a 30-60%	S		
No-burn agriculture (Fire management)	Natural Region <30%	S		**Productivity** Overall agro-ecosystem productivity is maintained with minimal impact on the environment. **Adaptation** Improved agro-ecosystem resilience. **Mitigation** Reduces GHG emissions from burning of biomass. Helps maintain both above and below ground biomass and hence carbon stocks.
	Natural Region 3 <30%	S		
Vegetables (2% of total harvested area)t				
Increased biomass systems (composting, green manure and mulching)	Natural Region 1 30-60%	S		**Productivity** Improves soil fertility and structure thus improving productivity and profits. **Adaptation** Improved water retention in soils. Increased system resilience. **Mitigation** Reduce requirement of synthetic fertilizers, hence reduce nitrous oxide emissions.

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Vegetables (2% of total harvested area)				
Increased biomass systems (composting, green manure and mulching)	Natural Region 2a) 30-60%	S		**Productivity** Improves soil fertility and structure thus improving productivity and profits. **Adaptation** Improved water retention in soils. Increased system resilience. **Mitigation** Reduce requirement of synthetic fertilizers, hence reduce nitrous oxide emissions.
Integrated livestock and vegetables system	Natural Region 1 30-60%	S		**Productivity** Increases productivity as a result of enhanced soil structure, health and fertility **Adaptation** Promotes soil structure conservation. Reduces erosion and enhances in-situ moisture conservation. **Mitigation** Maintains or improves soil carbon stocks and organic matter content. Long-term reduction in nitrogen-based fertilizers.
	Natural Region 2a 30-60%	S		
Rice (1% of total harvested area)				
System of Rice intensification	Natural Region 2 Western Region <30%	S		**Productivity** Increments in yield due to the higher number of tillers and better grain quality. **Adaptation** Enables larger area for cultivation even with limited water availability. **Mitigation** Reduced methane emission from rice field. Minimizes water use hence increase water use efficiency for rice cultivation.
	Natural Region 1 - Muchinga <30%	S		
Ripping	Natural Region 2 - Western Region <30%	S		**Productivity** Higher profits in the long term due to increased crop yields and reduced production costs. **Adaptation** Reduces soil erosion and improves moisture content avoiding water stress during dry periods. **Mitigation** Protects soil structure and organic carbon reserves in comparison to conventional tillage. Promotes fuel and energy saving due to reduced tillage operations.
	Natural Region 1 - Muchinga <30%	S		

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Sorghum (1% of total harvested area)				
Integrated pest and diseases management	Natural Region 2a <30%	S		**Productivity** Ensures crop production and quality, hence potential increases in income. **Adaptation** Reduces crop losses from pests and diseases even when cops are under moisture stress conditions. **Mitigation** Reduces GHG emissions by reducing use of synthetic pesticides..
	Natural Region 1 - South Luangwa valley and Southern Sesheke <30%	S		
Use of drought-resistant varieties	Natural Region 1 - South Luangwa valley and Southern Sesheke Natural Region 2a 30-60%	S		**Productivity** Promotes crop productivity and quality. Reduces production costs, hence potential increases in income. **Adaptation** Reduces crop losses even during abiotic-stress conditions. Promotes biodiversity conservation. **Mitigation** Reduces GHG emissions (carbon footprint) by reducing use of synthetic pesticides.
Sheep & Goats (NA)				
Use of improved breeds	Natural Region 1 - Southern & Eastern Province Natural Region 2b <30%	M L		**Productivity** Improved productivity (meat and milk. **Adaptation** Some breeds can present greater resistance to diseases and heat stress. **Mitigation** Reduced emissions per unit of inputs.
Improved housing	Natural Region 1 - Southern & Eastern Province Natural Region 2b <30%	S M L		**Productivity** Faster growth and higher feed conversion ratio due to proper housing. **Adaptation** Reduces exposure to adverse climatic conditions, reducing animal's stresses (e.g. cold waves). **Mitigation** Allows better manure management, thereby reducing the related GHG emissions.



Yield · Income · Water · Soil · Risk/Information · Energy · CO_2 Carbon · N_2O Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Pigs (NA)				
Improved housing	Natural Region 1 Natural Region 2a 30-60%	S M L		**Productivity** Faster growth and higher feed conversion ratio due to proper housing. **Adaptation** Reduces exposure to adverse climatic conditions, reducing animal's stresses (e.g. cold waves). **Mitigation** Allows better manure management, thereby reducing the related GHG emissions.
Use of improved breeds	Natural Region 1 Natural Region 2a <30%	M L		**Productivity** Reduces loss of asset and income from livestock, thereby increasing household profits. **Adaptation** Resilience to extreme climate conditions, without compromising production and quality of produce. **Mitigation** Reduces fodder/forage required for attaining maximum yield.
Cattle (NA)				
Integrated pest and diseases management	Natural Region 2b 30-60%	S M L		**Productivity** Ensures crop quality, hence potential increases in income. **Adaptation** Reduces crop losses from pests and diseases even when cops are under moisture stress conditions. **Mitigation** Reduces GHG emissions by reducing use of synthetic pesticides.
	Natural Region 1 <30%	S M L		
Use of improved breeds	Natural Region 1 Natural Region 2b 30-60%	M L		**Productivity** Improved productivity (meat and milk). **Adaptation** Reduces the risk to extreme climate conditions, without compromising production and quality of produce. **Mitigation** Reduces fodder/forage required for attaining maximum yield. Reduces pressure on natural resources.

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Chicken (NA)				
Cross breeding (using local and exotic varieties)	Natural Region 1 Natural Region 2a <30%	S		**Productivity** Increases quality and stability of the food production. Reduces production costs. **Adaptation** Local breeds can present greater resistance to diseases and heat stress. **Mitigation** Reduced inputs can reduce GHG emissions per unit of produce.
Improved housing	Natural Region 1 Natural Region 2a 30-60%	S M		**Productivity** Faster growth and higher feed conversion ratio due to proper housing. **Adaptation** Reduces exposure to adverse climatic conditions, reducing animal's stresses. **Mitigation** Allows better manure management, thereby reducing the related GHG emissions.

Institutions and policies for CSA

There are numerous institutions carrying out CSA-related initiatives in Zambia, ranging from government and non-government actors, to agencies of the United Nations (UN), private sector, and farmer's organizations, among others. Their work includes the provision of training and extension services (especially associated with CA, FMNR, agroforestry and efficient irrigation), policy advocacy, and awareness raising.

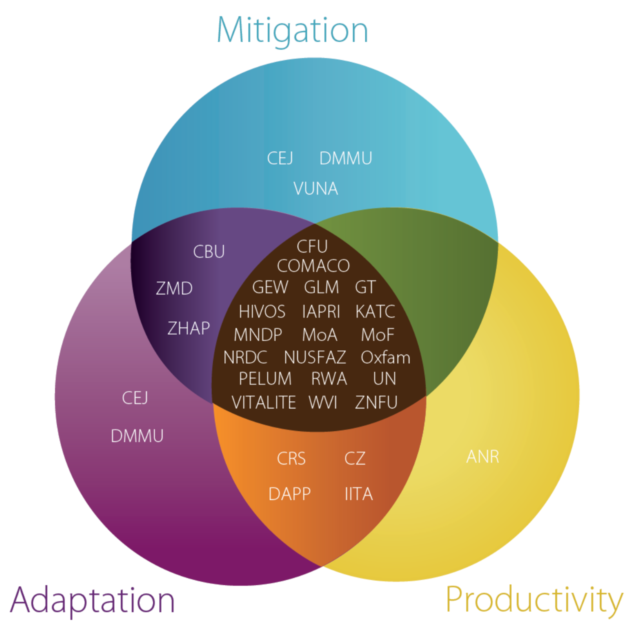
At national level, a number of government ministries and departments play a role in CSA promotion, directly or indirectly. The National Development Planning Department (NDPD) under the Ministry of National Development Planning (MNDP) hosts Zambia's Nationally Designated Authority (NDA). The Interim Inter-Ministerial Climate Change Secretariat, which is hosted by the Ministry of Finance, is Zambia's national coordinating body for all climate change-related activities in the country. The Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP) hosts the country's focal point to the UNFCCC and leads the formulation and implementation of climate change-related policies, strategies, and programs. The Ministry of Agriculture (MA) and the Ministry of Fisheries and Livestock (MFL) are the main governmental bodies engaged in the actual implementation of CSA work, through partnerships with various UN agencies. The Ministry of Lands and Natural Resources (MLNR) is mainly engaged in REDD+ activities such as forest management, development of national forest monitoring systems (NFMS) and monitoring, reporting and verification mechanisms (MRV).

International organisations such as the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Development Programme (UNDP) have supported the Government of Zambia to build the necessary policy, technical and financial enabling environments for CSA implementation, including knowledge sharing through national workshops and exchange visits on CSA, screening of national agricultural investment plans for CSA, the formulation of country-owned strategic frameworks for CSA, the formulation of CSA investment proposals and identify possible financing sources. Initial stakeholder consultations through this project identified CA; diversification of production (dairy, legumes); and addressing deforestation as key CSA focus areas for the country. FAO has also supported the integration of agriculture into the national adaptation planning (NAP) process through the NAP Global Support Programme.

Zambia was one of the three initial pilot countries for the Africa Climate-Smart Agriculture Alliance (ACSAA), a platform, which seeks to foster collaboration between government, research organisations, international organisations and NGOs (including CARE International, Oxfam, Concern, Catholic Relief Services (CRS), and World Vision) and has been focusing on the development of national CSA scaling-up plans. Additionally, Vuna, a regional programme funded by the UK Department for International Development (DfID), works on identifying and scaling up new and existing CSA technologies in the country through research on drought tolerant crops, training of agricultural extension agents on locally appropriate CSA practices and identifying and developing financial services for smallholder investment in CSA. Grassroots Trust is a local organisation actively involved in advocacy and training on CA, agroforestry, and other integrated CSA practices.

The Conservation Farming Unit (CFU) has since 1996 been involved in the promotion of CA, agroforestry and biochar in Zambia through development of guidelines, conducting trainings, and facilitating on farm CA field trials. Community Markets for Conservation (COMACO) provides inputs and trainings on conservation agriculture and value addition; buying excess produce from farmers who comply with the prescribed conservation practices and reselling to niche markets; a model that could do with further investigation on the potential for scaling up. Vitalite have promoted various green technologies such as charcoal saving cook stoves to reduce reliance on fuel wood. They also provide solar home systems through a credit facility for farmers and will soon be

Institutions for CSA in Zambia



ANR Alliance for Nutrition and Reconstruction **CBU** Copperbelt University **CEJ** Center for Environment Justice **CFU** Conservation Farming Unit **COMACO** Common Markets for Conservation **CRS** Catholic Relief Services **CZ** Caritas Zambia **DAPP** Development Aid from People to People **DMMU** Disaster Management and Mitigation Unit **GEW** Green Enviro-Watch **GLM** Green Living Movement **GT** Grassroots Trust **IAPRI** Indaba Agriculture Policy Research Institute **IITA** International Institution for Tropical Agriculture **KATC** Kasisi Agricultural Training Center **MNDP** Ministry of National Development Planning **MoA** Ministry of Agriculture **MoF** Ministry of Finance **NRDC** Natural Resources Development College **NUSFAZ** National Union for Small-Scale Farmers of Zambia **PELUM** Participatory Ecological Land Use Management Zambia **RWA** Rural Women's Assembly **UN** United Nations Agencies **WVI** World Vision International **ZHAP** Zambia Humanitarian Actors Platform **ZMD** Zambia Meteorological Department **ZNFU** Zambia National Farmers Union launching a remote video-based agricultural training system which could be applied to different CSA practices such s CA, IPDM and agroforestry. These organisation represent examples of private sector involvement in CSA.

The Indaba Agriculture Policy Research Institute (IAPRI), International Institute for Tropical Agriculture (IITA), and Zambia Agricultural Research Institute (ZARI) conduct research on a range of CSA practices such as intercropping methods, timing and combinations (focusing on maize-legume cropping systems with lablab, pigeonpea and *Gliricida Sepium*).

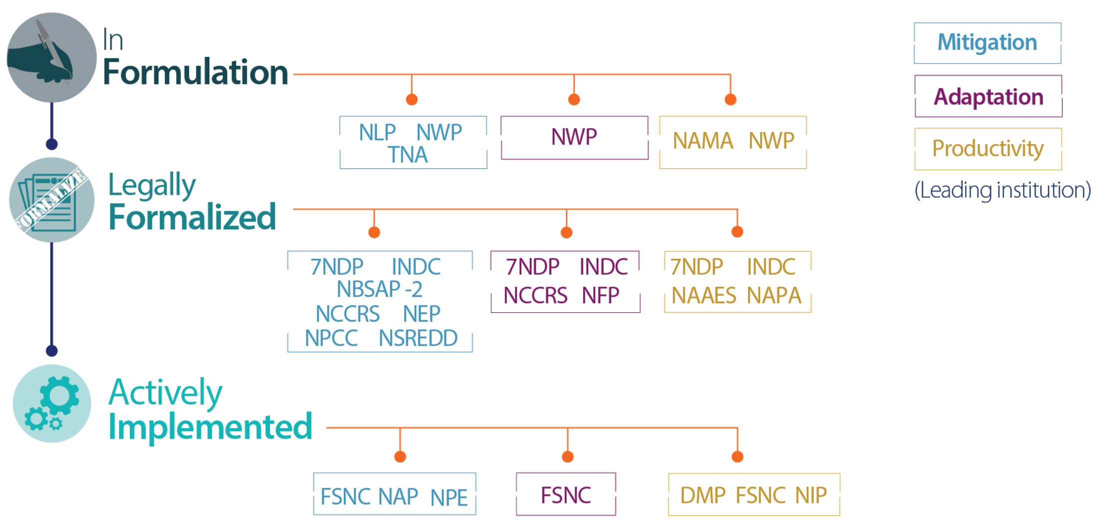
Two youth and women's organisations doing CSA work stand out. The Rural Women's Assembly, which works largely on advocacy related to agroecology, engaging in and holding lobbying events at major national, regional and international for a related to agriculture and climate change. The Zambia Youth Network on Climate Change conducts similar CSA related advocacy and lobbying activities, but from a youth perspective.

The following graphic highlights key institutions whose main activities relate to one, two or three CSA pillars (adaptation, productivity and mitigation). More information on the methodology is available in Annex 3.

In terms of policies, the Government of Zambia ratified the UNFCCC in 1993 and signed the Kyoto Protocol in 2006. Additionally, two national communications have been submitted to the UNFCCC. As a Least Developed Country (LDC), Zambia developed its National Adaptation Programme of Action (NAPA) in 2007, to address urgent and immediate adaptation needs. The programme focused on four key areas including agriculture, water and energy, natural resources (forests and wildlife) and human health, all with a relation to CSA. In 2015, the Government also submitted its Intended Nationally Determined Contribution (INDC), in which CSA practices such as agroforestry, fire management, water management, biogas, use of drought tolerant varieties and conservation agriculture were identified as a key intervention area to achieve mitigation and adaptation goals. The INDC targets a 47% reduction in emissions from the business as usual scenario but this is conditional on climate finance of US$35 billion to be mobilised through climate instruments such as the GCF. The INDC builds on a number of policies, including: the National Policy on Environment (NPE), the National Climate Change Response Strategy (NCCRS), the National Forestry Policy (NFP), the National Agriculture Policy (NAP), the National Strategy for Reducing Emissions from Deforestation and Forest Degradation (NS-REDD+), the Second National Biodiversity Strategy and Action Plan (NBSAP2)[20], the Technology Needs Assessment (TNA) and the Nationally Appropriate Mitigation Actions (NAMAs), among others.

Zambia is also in the process of developing its Seventh National Development Plan (SNDP, 2017-2021), which will include a focus on climate change and on stimulating agricultural development.

Policies for CSA in Zambia



7NDP 7th National Development Plan (2015) (MNDP) **DMP** Disaster Management Policy (2015) (DMMU) **INDC** Intended Nationally Determined Contribution (2015) (MWDSEP) **NAAES** National Agricultural Advisory and Extension Strategy (2016) (MoA) **NAMA** Nationally Appropriat Mitigation Actions (2017) (MoA) **NAPA** National Adaptation Plan of Action (2007) (MWDSEP) **NAP** National Agriculture Policy (2017) (MoA) **NBSAP -2** Second National Biodiversity Strategy & Action Plan (2015) (MLNR) **NCCRS** National Climate Change Response Strategy (2010) (MWDSEP) **NEP** National Energy Policy (2008) (MEWD) **NFP** National Forestry Policy (2014) (MLNR) **NIP** National Irrigation Policy (2017) (MoA) **NLP** National Land Policy (2015) (MLNR) **NPCC** National Policy on Climate Change (2016) (MLNR) **NPE** National Policy on Environment (2007) (MLNR) **NSREDD** National Strategy to Reduce Emissions from Deforestation and Forest Degradation (2016) (FD) **NWP** Wetlands Policy (MWDSEP) **TNA** Technology Needs Assesment (2013) (MLNR)

20 Zambia's NBSAP2 specifically mentions the promotion of CSA practices as a key strategy for food security at household and national level.

The National Agricultural Advisory and Extension Strategy (NAAES) for 2016-2020 includes a component on supporting smallholder adaptation to climate change though irrigation, diversification, and agrometeorological information, but also specifically mentioning the need to promote mitigation practices such as agroforestry, manure management and bioenergy.

Zambia's National Climate Change Response Strategy (2010) takes a sectoral approach to addressing climate change adaptation and mitigation, focusing on investments in sustainable land use (agriculture and forestry sectors), early warning, and agro-climatic information.

Zambia is also in the process of developing a Green Climate Fund (GCF) proposal related to "Sustainable Agriculture through Integrated Crop and Livestock Farming", which aims to reduce emissions from the agricultural sector by 32-38% from the baseline by 2022, through conservation agriculture, manure management (including use of biogas digesters), and improved pastures.

In terms of forestry, the National Policy on Environment (2007), the National Strategy for Reducing Emissions from Deforestation and Forest Degradation (REDD+, 2015), and the National Forestry Policy (2014) include issues on forest management and promotion of agroforestry.

Zambia has taken several steps to integrate climate change and agriculture into national development planning as well as to specifically ensure that CSA forms part of the country's national adaptation and mitigation goals and commitments. With funding from both national and international sources, the policies and strategies can be effectively implemented. In this regard, awareness raising and training of CSA stakeholders from national to local level will be of great importance for the successful design, implementation, and monitoring of CSA programmes and projects that help to translate the range of available policies and strategies into actions on the ground. Leveraging private sector expertise and capital to support implementation of these policies will also be beneficial.

The graphic shows a selection of policies, strategies and programs that relate to agriculture and climate change topics and are considered key enablers of CSA in the country. The policy cycle classification aims to show gaps and opportunities in policy-making, referring to the three main stages: policy formulation (referring to a policy that is in an initial formulation stage/consultation process), policy formalization (to indicate the presence of mechanisms for the policy to process at national level) and policy in active implementation (to indicate visible progress/outcomes toward achieving larger policy goals, through concrete strategies and action plans). For more information on the methodology, see Annex 4.

Financing CSA

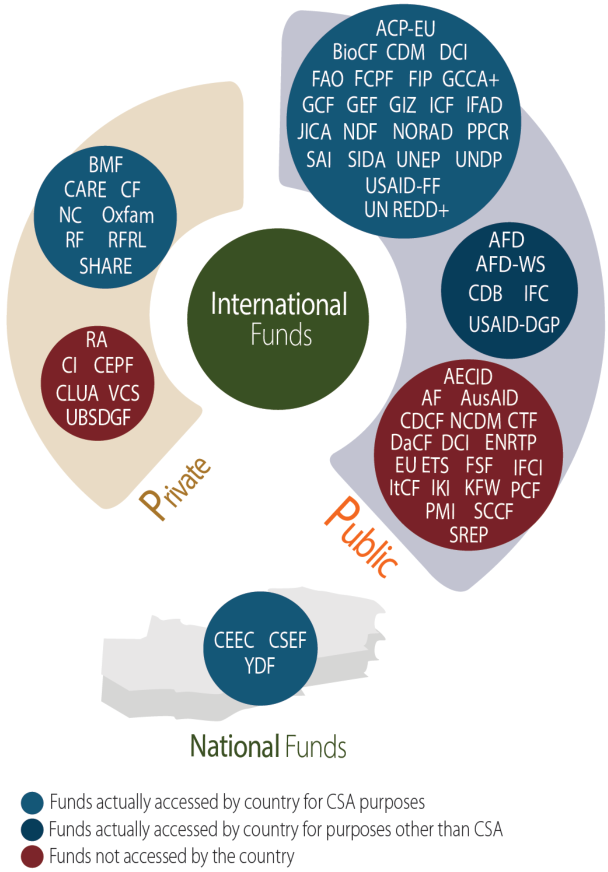
Financing is critical for incentivizing farmers and communities, public institutions and private sectors to invest in development and promotion of CSA in Zambia. The graphic highlights existing and potential financing opportunities for CSA in Zambia. The methodology can be found in Annex 5.

One of the main sources of international climate financing for Zambia has been the Global Environment Facility (GEF), for which the country has already accessed approximately US$ 49 million for 15 initiatives and has been involved in an additional US$ 301 million worth of regional projects. Projects worth US$ 17 million were also carried out with support from the Least Developed Countries Fund (LDCF) [28]. Many of these projects were related to adaptation and mitigation in agriculture and forestry focusing on community forest management, promotion of drought resistant livestock breeds and improved early warning information for farmers. In 2015, Zambia was also able to access US$ 300,000 through the Green Climate Fund (GCF) readiness programme, to support institutional capacity building and the identification of adaptation and mitigation programmes, in preparation for implementation of the INDCs. Other big sources of funding include multi- and bilateral partners, such as the World Bank, African Development Bank (AfDB), UN agencies, DFID, Swedish International Development Cooperation (SIDA), Norwegian Development Agency (NORAD), the European Union, and the United States Department for International Development (USAID) among others. The World Bank is partially financing the Zambia Integrated Forest Landscape Project (ZIFLP) being implemented through partners such as the Biocarbon Partners Limited and Netherlands Development Agency (SNV); a project which focuses on promotion of agroforestry, conservation agriculture and integrated soil fertility management (ISFM). Zambia has also accessed funds from the Clean Development Mechanism (CDM) for a project related to fuel efficient cook stoves.

Governmental spending on agriculture decreased from 11% in 2007 to below 7% in 2012. In 2015, the figure was just under 10% of the national budget. Agricultural research expenditure including salaries, operating and program costs, as well as capital investments by government, NGOs, and higher education institutions has been estimated at 0.5% of the total agricultural GDP (the equivalent of US$ 27 million) in 2014, representing an 80% increase from 2008 due to donor contributions and loans from multilateral sources [29].

At national level, the Citizens Economic Empowerment Commission (CEEC) provides grants to support small business, including in areas related to aquaculture, smallholder irrigation development (such as the Irrigation

Financing opportunities for CSA in Zambia



ACP-EU African, Caribbean and Pacific-European Union Energy Facility **AECID** Spanish Agency for International Development **AF** Adaptation Fund **AFD** French Development Agency **AFD-WS** French Development Agency- Water and Sanitation **AusAID** Australian Agency for International Development **BioCF** World Bank BioCarbon Fund **BMGF** Bill and Melinda Gates Foundation **CARE** Cooperative for Assistance and Relief Everywhere **CDB** China Development Bank **CDCF** Community Development Carbon Fund **CDM** Clean Development Mechanism **CEPF** Critical Ecosystem Partnership Fund **CF** The Clinton Foundation **CI** Conservation International **CLUA** Climate and Land Use Alliance **CTF** Clean Technology Fund **DaCI** Danish Carbon Fund **DCI** Development Cooperation Instrument **ENRTP** Environment and Sustainable Management of Natural Resources Thematic Programme **EU ETS** European Emissions Trading System **FAO** Food and Agriculture Organization of the United Nations **FCPF** Forest Carbon Partnership Facility **FIP** Forest Investment Program **FSF** Japan's Fast-Start Financing **GCCA** Global Climate Change Alliance **GCF** Green Climate Fund **GEF** Global Environment Facility **GIZ** German Society for International Cooperation **ICF** United Kingdom International Climate Fund **ItCF** Italian Carbon Fund **IFAD** International Fund for Agricultural Development **IFC** International Finance Corporation **IKI** International Climate Initiative **JICA** Japan International Cooperation Agency **KfW** German Development Bank International Climate Initiative **NC** The Nature Conservancy **NCDM** The Netherlands Clean Development Mechanism **NDF** Nordic Development Fund **NORAD** Norwegian Agency for Development and Cooperation **PCF** Prototype Carbon Fund **PMI** Partnership for Market Initiatives **PPCR** Pilot Program for Climate Resilience **RA** Real Assets Forest Investment **REDD** United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation **RF** Rockefeller Foundation **RFRL** Rabobank Farm and Rural Lending **SAI** Sustainable Agriculture Initiative Platform **SHARE** Sending Help and Resources Everywhere **SIDA** Swedish International Development Cooperation Agency **UNDP** United Nations Development Programme **UNEP** United Nations Environmental Programme **SCF** Spanish Carbon Fund **SCCF** Special Climate Change Fund **SREP** Scaling Up Renewable Energy in Low Income Countries Program **UBSDGF** Union Bank of Switzerland Dutch Green Fund **USAID-DGP** United States Agency for International Development – Development Grants Program **USAID-FF** United States Agency for International Development – Feed the Future **VCS** Verified Carbon Standard

Fund), renewable energy, and value addition. The National Youth Fund also awards grants for agriculture-related projects, while the Civil Society Environmental Fund (CSEF) supported by the Finnish Government has funding for environment- and agriculture-related projects. These local funding instruments mostly award small grants or loans targeted at community based organizations focusing on the environment, youth, women and vulnerable groups. However, none of these actors have specific CSA-targeted funding schemes.

The Zambia National Commercial Bank (ZANACO) and the Development Bank of Zambia (DBZ) fund agricultural development projects and have been selected by the country's NDA for accreditation to the GCF. Once this is formalized, the involvement of these banks in promoting agricultural climate change adaptation and mitigation initiatives will likely be increased.

At a first sight, most of the agricultural climate change finance in Zambia is being directed towards to adaptation and productivity enhancement projects, with relatively few finances (with the exception of REDD+) being targeted for climate change mitigation. This is also a reflection of the country's priorities of reducing poverty and increasing food security and nutrition of the population. However, despite the active engagement of foreign actors in agricultural and climate finance, significant gaps remain when it comes to funding CSA-related technology development and dissemination, monitoring and evaluation, coordination of ongoing CSA efforts, as well as improved research systems to develop a stronger evidence base for CSA scale out.

In general, finance that can enable CSA promotion and scale out mainly relies on international public and private sources. It is not so clear how much climate finance is being directed to the agricultural sector and whether this is for adaptation or mitigation or both. In this regard, the Zambia Climate Change Network and the Climate Change Secretariat were developing a climate finance tracking tool for the country.

Potential Finance

In 2014, the NDPD was nominated as the Nationally Designated Authority (NDA) for GCF Funds, with three organisations nominated as nationally accredited entities (AEs), namely ZANACO, DBZ, and the Ministry of Finance. Zambia's NDA has already placed an open call for GCF proposals, leading to the submission of 40 concept notes [30], with key topics including: livelihoods enhancement for smallholder farmers in rural zones of the country, strengthening the integration of the country's hydrological and meteorological services in national planning and emergency frameworks, and reducing emissions from dairy production, among others.

Along with GCF funding, which represents a large CSA funding opportunity for Zambia, another potential source of climate finance which the country has not accessed so far is the Adaptation Fund (AF). Forestry related funding mechanisms such as REDD+ present an opportunity to scale up agroforestry in the country and this opportunity could be further explored.

Additionally, Zambia is in the process of establishing a National Climate Change Fund (NCCF), which will be used as a means of channelling and coordinating international and national finances for climate change adaptation and mitigation programmes and projects.

The private sector also presents an opportunity for increasing investment in CSA, particularly through private-public partnership (PPP) for investments in knowledge and technology development and dissemination, credit and insurance access for smallholders. While Zambia's NDA has already invited the private sector to submit GCF concept notes, there is need for a comprehensive private sector engagement strategy on CSA to facilitate private-public investments in technology development and dissemination, agricultural credit, value chain development, and weather insurance for smallholders. Increasing awareness of the opportunities, costs and benefits of private investments in smallholder agriculture (de-risking the investment) could be an important step for public-private partnership on CSA.

Outlook

Zambia has taken several steps to create the institutional, technical, and political environment for the adoption and scaling out of CSA practices and technologies, being regarded as one of the leaders in agroforestry and conservation agriculture in Africa. This has been facilitated by various efforts, including: the elaboration of a National Climate Change Strategy, development of CA guidelines, mainstreaming of climate change across the countries' development priorities (including the countries Seventh National Development Plan), and capacity building of relevant institutions and actors on climate change, among others.. The country has also implemented various programmes and projects incorporating climate-smart agriculture practices and technologies, with a host of CSA related projects still under development.

By complementing on-going programmes and projects related to CSA, the steps being taken to develop GCF proposals and institutions, and the process of establishing its own national fund for climate change (the NCCF), the country is likely to access important GCF funding for agricultural adaptation and mitigation in the near future. This Country Profile can serve as an input for investment prioritization, as well as a model for further identification and documentation of CSA practices and technologies in different AEZs, their impact, and enabling environments to promote them, making sure that future funding is directed towards initiatives that are technically-, socially- and environmentally- feasible and appropriate to the context they are targeted.

Knowledge on CSA is still low and there is need to undertake wide awareness raising and sensitization through national workshops, farmer outreach, print and digital media, and learning visits to ensure that there is a common understanding of what CSA comprises in the Zambian context. This will reduce misinterpretation of messages and promote a shared vision for CSA in the country.

Lastly, it should be noted that of recent years Zambia has been one of the countries in Southern Africa that has managed to withstand the effects of droughts. As a result, Zambia has been a net exporter of grains and cereals mostly to neighboring countries whose agricultural production have been negatively affected by climate related hazards, particularly droughts. This however, should not serve as an excuse for not adequately investing in climate-smart agriculture.

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For further information and online versions of the Annexes

Annex 1: Selection of agricultural production systems key for food security in Zambia (methodology)
Annex 2: Methodology for assessing climate-smartness of ongoing practices
Annex 3: Institutions for CSA in Zambia (methodology)
Annex 4: Policies for CSA in Zambia (methodology)
Annex 5: Assessing CSA finances in Zambia (methodology)

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