Climate-Smart Agriculture in Malawi

Climate-smart agriculture (CSA) considerations

A P Agriculture accounts for 30% of Malawi's Gross Domestic Product (GDP), and is important to the livelihoods of more than 90% of the population.

A P Economic growth in Malawi is linked to growth in agricultural GDP, which depends on climate. Agricultural production is mainly oriented towards tobacco for export and maize for food.

P Productivity of the Malawian agricultural sector is below potential despite the apparent success of the Farm Input Subsidy Program (FISP) that reportedly increased maize productivity from 1480 kg/ha in 2006 to 2100 kg/ha in 2013.

A M I Adoption of Climate Smart Agriculture (CSA) practices remains low in Malawi. For instance, adoption of Conservation Agriculture (CA) is at 1-2% of cultivated land, and only about 4% of cultivated land is under irrigation. The main impediments to large-scale adoption of CSA are lack of appropriate knowledge, poor access to financial resources, and tenure insecurity; these challenges disproportionately affect smallholder farmers.

A M I $ There are about 308 CSA-related projects currently being implemented nationally; only circa 14% are exclusively for CSA.

I Coordination among stakeholders in climate change and CSA is a major challenge in the country, and has resulted in duplication of effort, unsustainability of interventions, and low adoption levels of climate smart practices.

P Although CA has been promoted in Malawi for many years, differing perspectives amongst organizations promoting CA contribute to a poor understanding of the concept among farmers. This, among other factors, has resulted in the low adoption, and sometimes dis-adoption, of CA in the country.

P Agricultural productivity is low in Malawi especially for female-managed farms (25% lower than male-managed farms). The difference arises from disparities in resource endowment that puts female farmers at a disadvantage in terms of input use. Managed farms are characterized by low inorganic fertilizer use, low production of high-value export crops, and poor access to agricultural tools.

$ Adaptation of the agriculture sector to climate change will require circa USD 55 million per district annually. This implies a very large budget requirement for adaptation of the country's entire agriculture sector. Long-term planning (rather than reactionary efforts in the face of emergencies) will be more cost effective.

$ A lack of awareness (by experts in different institutions) of available climate financing mechanisms is the major contributor to the poor access to finances for promoting adaptation in Malawi.

$ The main funders of CSA-related programmes and projects include the World Bank and the African Development Bank (AfDB), and bilateral institutions such as USAID, DFID and the European Commission. United Nations agencies such as FAO, UNDP and UNEP also make significant financial and technical contributions. However, more can be done to ensure greater access to climate change funds. Funding for forestry-related initiatives is also severely limited.

I The Malawian government has made remarkable progress in incorporating climate change in its development plans, policies, and strategies. However, an implementation gap is the main barrier to achieving anticipated outcomes. Insufficient human capacity in relevant institutions and weak private-public partnerships contribute to the gap.

I CSA research (to identify farmer needs, barriers to adoption, and mechanisms to better support farmer organizations) needs to be enhanced through collaboration between government, the private sector, international research institutes, and development partners.

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. CSA aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives can sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), but require planning to address trade-offs and synergies between the three CSA pillars, namely: productivity, adaptation, and mitigation(1). The priorities of different countries and stakeholders can converge towards achieving more efficient, effective, and equitable food systems that address challenges in environmental, social, and economic dimensions across productive landscapes. While the CSA 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 different types of 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 and scaling. This country profile provides a snapshot of a baseline created to initiate discussions on entry points for investing in CSA at scale in Malawi.

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CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

CIAT 50 1967-2017

National context

Economic relevance of agriculture

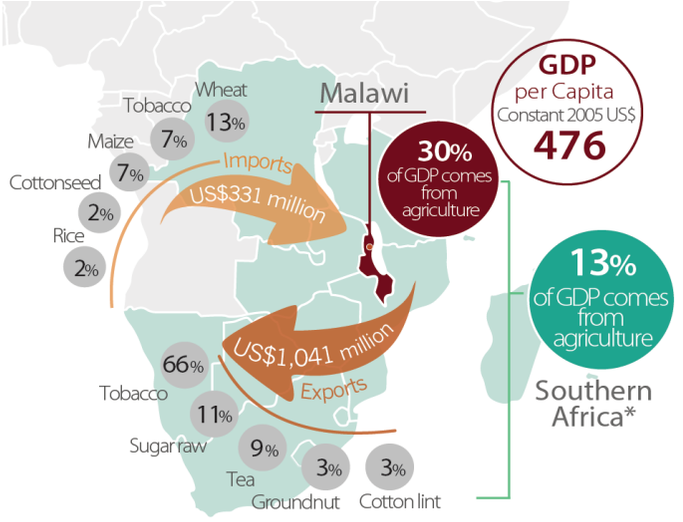
Agriculture plays a major role in the economy of Malawi. The sector contributed approximately 30% to the national Gross Domestic Product (GDP) during the period 2012-2016 (3), employs over 80% of the economically active population (59% women and 41% men)[1], and is the main source of livelihood for more than 2 million rural smallholder farmers. Women play an important role in agriculture. They constitute 70% of full time farmers, carry out 70% of the agricultural work, and produce more than 80% of subsistence crops. Tobacco is the major national export (66% of agricultural export). Raw sugar, tea, groundnut, and cotton lint are also significant export products (11%, 9%, 3% and 2.7% of total exports, respectively). Smallholder farmers disproportionately produce crops for domestic consumption. They produce approximately 80% of all food consumed in Malawi. By contrast, smallholder farmers produce just 20% of agricultural exports. In Malawi, smallholder production accounts for nearly 70% of the agricultural GDP. The major domestic food crops are maize, rice, cassava, legumes, sweet potato and Irish potato.

The agri-sector has had significant growth in recent years, reaching the 6% growth rate target set forth by the Comprehensive Africa Agriculture Development Programme (CAADP), to which Malawi is a signatory. This growth can be primarily attributed to land reforms, which strengthened tenure security and promoted equal access to land for smallholder farmers. Increased investments in the agriculture sector (e.g. through the Farm Input Subsidy Program (FISP) also served to augment fertilizer use and, consequently, crop productivity, particularly for maize. Malawi is among the very few countries in Africa that has attained a 10% budgetary allocation to the agricultural sector over the last decade. However, a large portion of the agri-budget covers recurrent expenditures, such as salary payments (4), and the FISP (which prioritizes select crops), at the expense of other pertinent issues such as research and improvement of extension services. Low productivity, market failures, (aggravated by some counter-effective trade policies), and climate vulnerability further challenge the agri-sector.

Malawi is a low-income country characterized by a high population growth rate (about 3.06%) and high poverty levels. The current population is estimated at 18 million people, of which 83% live in rural areas. Approximately 51% live below the national poverty line of USD $1 / day (4). A significant contributor to the high poverty level is the lack of alternative livelihood options, particularly in rural areas; all 18 livelihood zones in the country are based on agriculture[2]. The services sector (e.g. transport, tourism, insurance and construction), and industry sector (e.g. mining and manufacturing) contribute 51% and 18% of GDP, respectively (5). However, these do not support the majority of the people in rural areas. Development of the agro-processing sector presents an opportunity for economic development in both rural and urban areas.

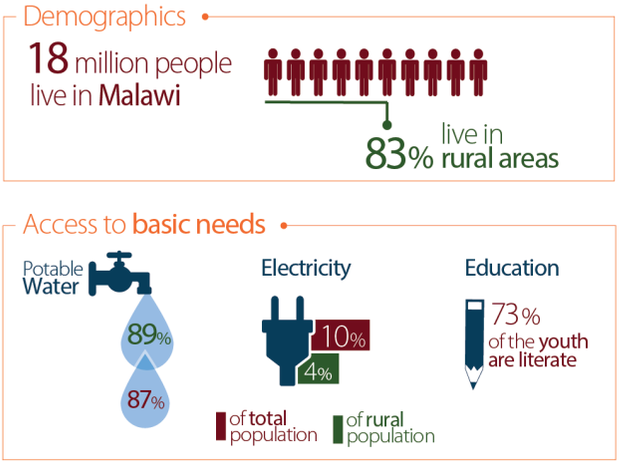
Quality of life indices in Malawi are also low. Malawi's Human Development Index (HDI)[3] is among the lowest in the world (0.476). This is due to major disparities in economic growth and development, especially between urban and rural areas, and between men and women. For instance, access to electricity in rural areas (3.7%) is significantly lower than the national average of about 10%).

Economic relevance of agriculture in Malawi [5, 6]



*Southern Africa: Botswana, DRC, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe

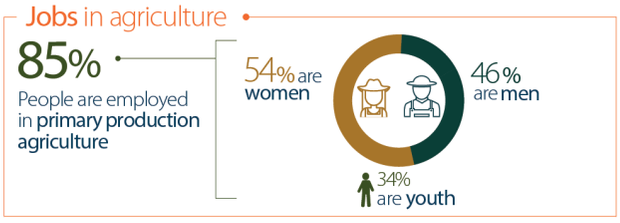
People, agriculture and livelihoods in Malawi [5, 6, 8]

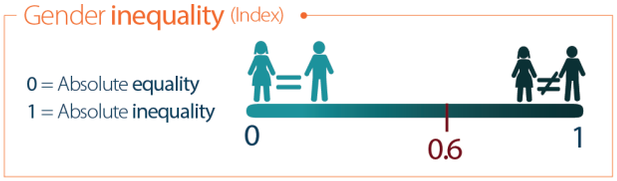


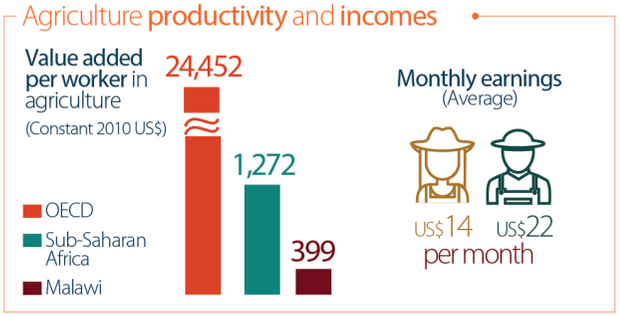
1 This is according to the 2008 Population and Housing Census. See link: http://www.nsomalawi.mw/images/stories/data_on_line/demography/census_2008/Main%20Report/Census%20Main%20Report.pdf

2 See the Production Systems section for further information on livelihoods zones.

3 A measure used by the United Nations to determine progress in development focusing on three fundamental indicators, namely life expectancy, literacy level and per capita income.







Land use

Malawi is a landlocked country with a total area of 118,484 km^2, 20% of which is covered by water (mostly Lake Malawi). While 5,738,000 ha (approximately 61% of the land area) are suitable for agriculture, only 2,500,000 ha are under cultivation (6). Permanent meadows and pastures, forest area, and other forms of land cover account for roughly 20%, 34% and 5% of land area, respectively. Land ownership is skewed: the wealthy own more land and have better tenure security. Only 32% of agricultural landholders are women. Estates hold 13% of land, and smallholders own 69% (7).

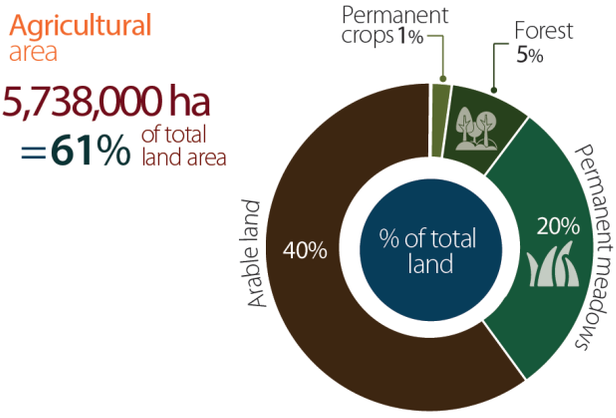
The average holding size for poor households (per capita consumption is less than a dollar a day) is about 0.23 ha compared to 0.42 ha in wealthier households. There are also inter-regional variations in land holdings: the southern region has fewer households (3%) cultivating 4-6 acres, while other regions are cultivating circa 8 acres (8). The per capita holding size in the southern region declined from 0.4 ha in the 1970s to about 0.2 ha in 2007, primarily due to increasing population and associated land fragmentation (9).

Land tenure in Malawi is classified into customary, public land, and private land (10), accounting for 68%, 20% and 12% of the land respectively (9). Like many African countries, Malawi has experienced challenges with land tenure security. Until 2002, the country operated under a colonial land policy that systematically favored large-scale farmers, and in particular foreign settlers. Most smallholder farmers still lack documented land rights; this translates into inefficient use of scarce resources, low agricultural productivity, and increased risk of land degradation. Weak land legislation reduces agriculture productivity (especially for female-managed farms) since farmers have less motivation to undertake long-term investments in the pieces of land they cannot guarantee will remain under their control. Weak land legislation also increases the transaction costs for obtaining credit.

The above challenges drove the formulation of the national land policy, which improves customary land security and equal access to land for all, among other provisions. Subsequent land bills build on the policy by further addressing, in particular, customary land issues.

How the interplay of various recent government initiatives including the promotion of afforestation and reforestation, improved security for customary land holders, and the commitment, under the New Alliance for Food Security and Nutrition in Malawi, to increase the area under commercial agriculture by 200,000 ha per annum will affect land use and availability in the future remains to be seen.

Land use in Malawi [5]



Agricultural production systems

Malawi is classified into three agro-ecological zones (AEZs) based on soil factors, altitude, the amount, duration, and variability of rainfall, and temperature regimes[4]: the Lower Shire valley; the lakeshore plains and Upper Shire valley; and the mid-altitude plateau, with the highlands sometimes counted as a fourth. There are two distinct seasons: a wet, warm season from October to April, and a dry, cool season

from May to September (5) The country is further divided into 18 livelihood zones based on geography, agricultural production systems (crop and livestock), and markets (11). These livelihood zones have different development needs and priorities.

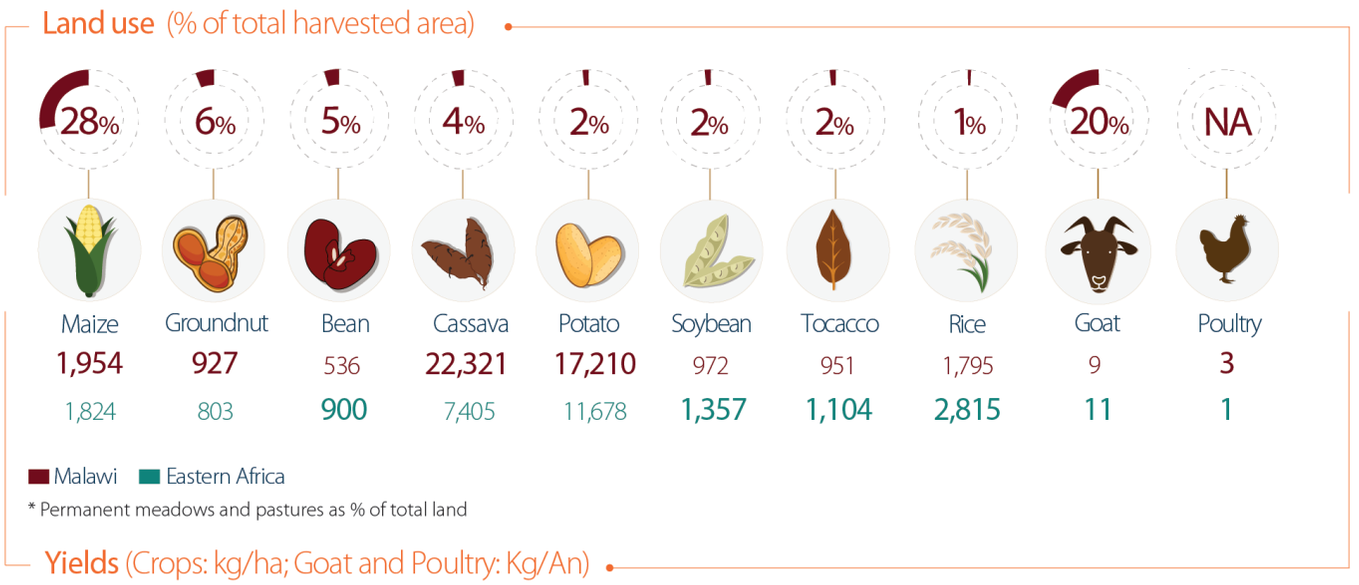
Malawian producers are primarily small-scale (less than 1 ha), with some large-scale (more than 25 ha) producers. There is an emergence of medium scale farmers cultivating not less than 5 ha and not less than 25 ha of land (6). Large-scale producers are almost exclusively involved in production of tobacco, tea, sugar, and macadamia for export. Small-scale producers are mostly subsistence farmers cultivating maize, rice, cassava, legumes and sweet potato[5]. The biggest estates are located in Thyolo, Mulanje and Nsanje districts in the south (for tea production), and some areas in the central and northern regions (for tobacco production). Sometimes these large farms engage smallholder farmers through contract farming.

More than 90% of agri-production is rain-fed with only 4% of the total cultivated area irrigated (5). Women (i.e. women managed farms) are disadvantaged in terms of access to irrigation technologies, and finances (12). Some farmers, (mostly in Salima, Karonga and the lower Shire which are all vulnerable to floods), also practice recessional agriculture[6] (6% of production), resulting in another harvest season for these regions. Most smallholder farmers still use rudimentary farming practices (e.g. hand-held hoes and watering cans) and depend on family labor. Use of inputs (e.g. fertilizers) is still low, albeit higher than regional averages, with disparities between urban and rural farmers: 70% of the former use fertilizer, compared to only 55% of the latter. There are also fertilizer use differences between male and female-headed households (57% for male-headed, and 50% for female-headed). Women farmers also have less access to irrigation technologies and finances (12). Maize, grown by 95% of the farmers, is the major crop (11), covering approximately 60% of the crop area.

Livestock production is concentrated in the northern region (13) mostly under extensive grazing in communal lands. Intensive livestock production is found mostly on the estates. The most common livestock in Malawi are cattle, goats, pigs and poultry. Approximately 51% of households own livestock (14). Goats are kept across all the country's livelihood zones, mostly by female-headed households, while cattle are kept in 10 of the 18 livelihood zones, mostly by the wealthy, who use them for milk, and, in the case of oxen, for draft power.

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

Production Systems Key for Food Security in Malawi [5]

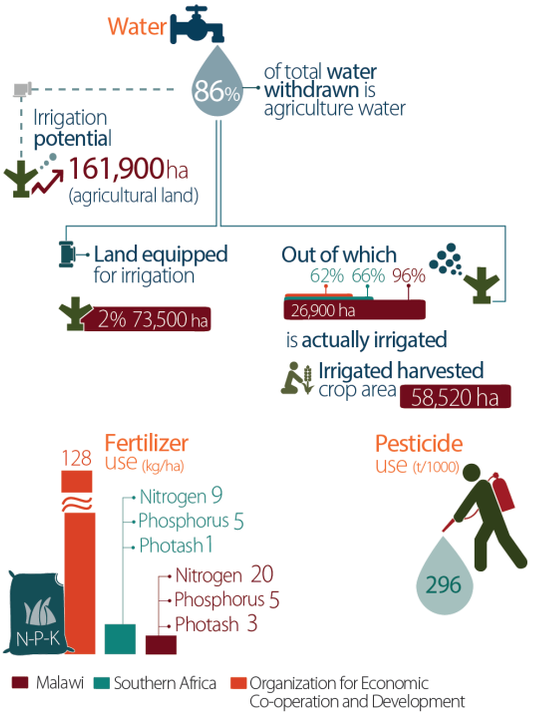


4 More details on the temperature regime classifications are available at: https://www.canr.msu.edu/fsp/publications/research-papers/FSP%20Research%20Paper%2017.pdf

5 Sweet potato is produced throughout the country, and is considered to be well to both floods and drought prone areas.

6 This is the practice of planting in flooded areas after the waters recede.

Agricultural input use in Malawi [5, 6, 18]



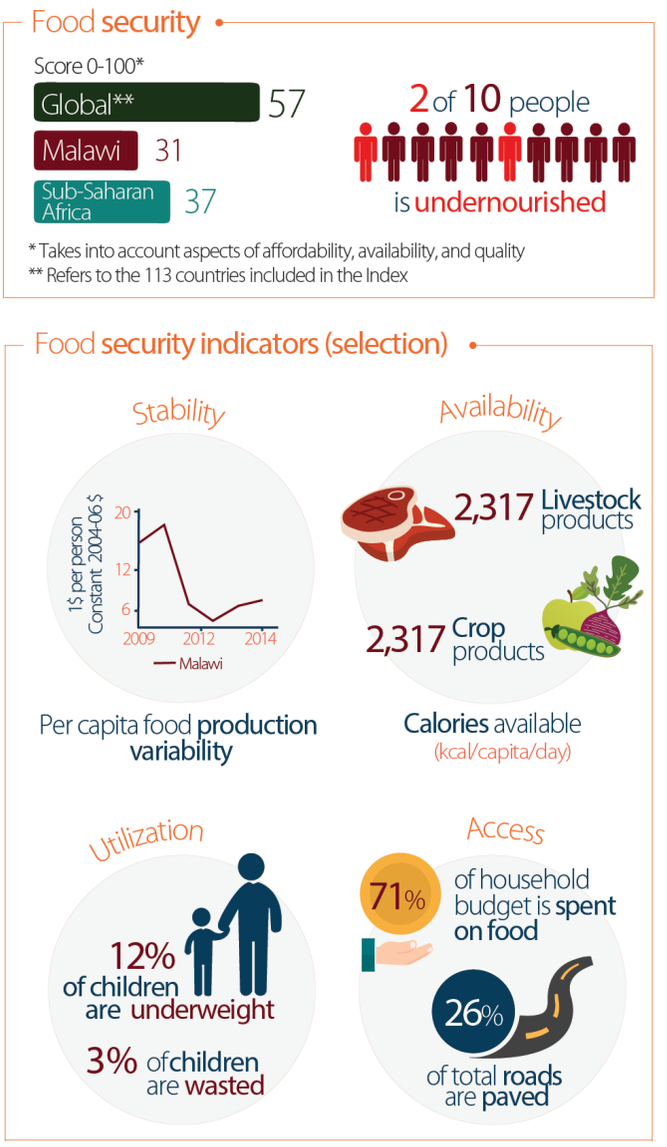
Food security and nutrition

Food security and nutrition are major objectives of a number of government policies in Malawi, including the National Agriculture Policy (NAP) and the Agriculture Sector Wide Approach (ASWAp). However, Malawi remains one of the most food insecure countries in the world, ranking 105 out of 133 in the global food security index in 2017[7]. Approximately 23% of the population is undernourished, and about 12% and 3% of children under the age of 5 years are underweight and wasted respectively (see infographic below). According to the Malawi Integrated Household Survey, about 36.7% of households fail to access sufficient calories in each year[8]. Calorie deficiency varies with region; the highest deficiency levels (> 60% of households) are found in Chikwawa, Lilongwe and Nsanje; the lowest (<35% of households) are in Blantyre, Mzimba and Ntchisi (11). Such challenges persist despite the progress the country has made in reducing the numbers of people vulnerable to hunger and undernutrition. More needs to be done to improve the quality of the diets of the poor in Malawi

Food insecurity is influenced by climatic factors (e.g. the southern drought-vulnerable region experience high levels of nutritional insecurity) and volatile agricultural markets. Over-reliance on maize for calorie supply and weak linkages between agriculture and nutrition in the policy framework aggravate the food security situation (15)[9].

There are a number of opportunities for improving food and nutrition security. These include addressing seasonality through supporting value chains for nutrient-dense foods and increasing the use of native, wild, and foraged foods in diets. There is a need to better foster synergies between the health and agriculture sectors in terms of nutrition. There is also a need to ensure that market systems and the food production environment are working better for smallholder producers.

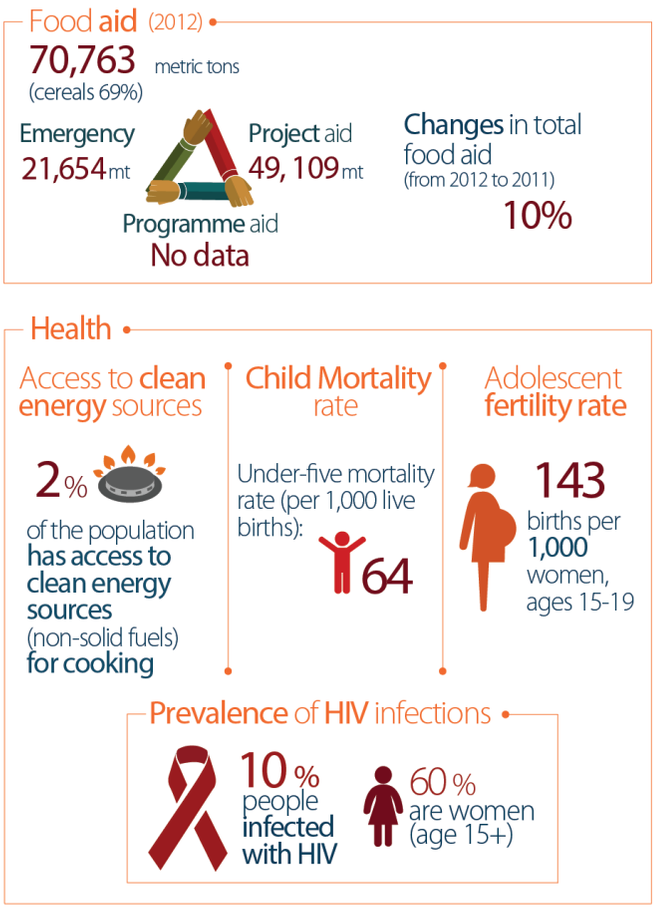
Food security, nutrition and health in Malawi [5, 6]



7 https://foodsecurityindex.eiu.com/Country/Details#Malawi

8 The WFP comprehensive food security and vulnerability analysis (CFSVA) and nutrition assessment reports that almost half (47%) of the population is food energy deficient.

9 IFPRI (2018) outlines the pathways through which agriculture can lead to improved nutrition in Malawi.



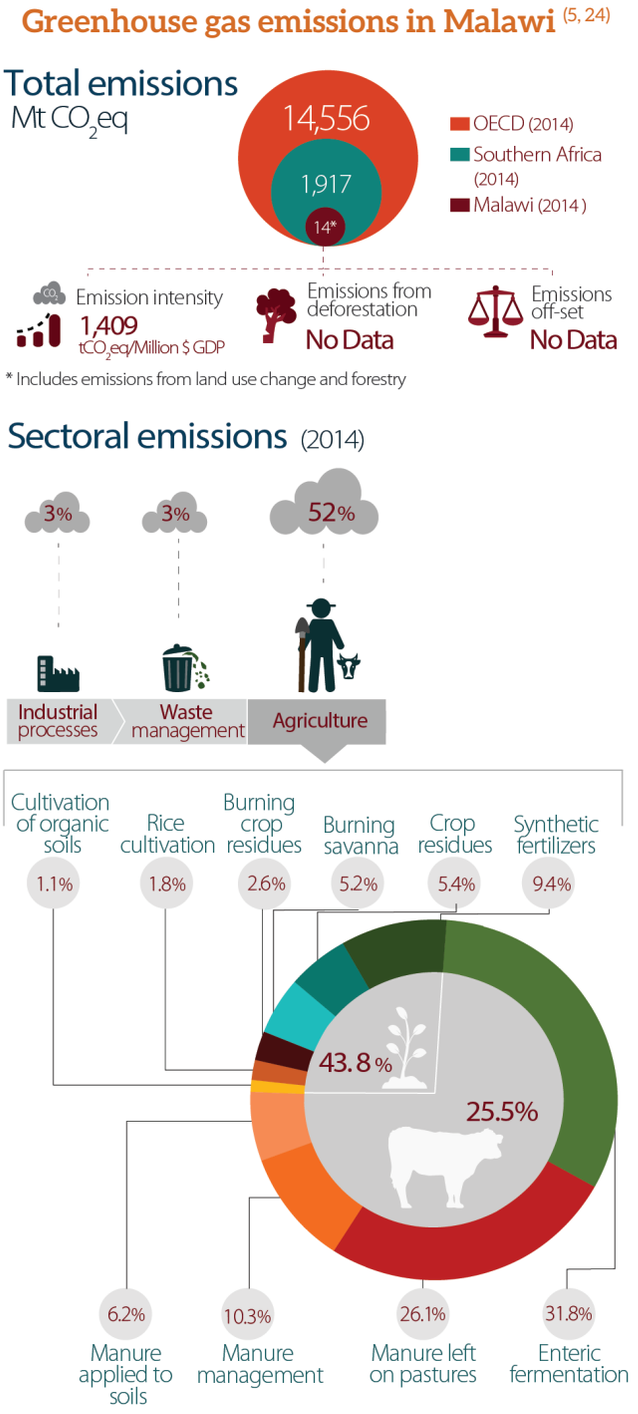
Agricultural greenhouse gas emissions

Malawi has among the lowest emissions in the Southern Africa region, averaging about 14.54 Mt CO_2e (carbon dioxide equivalent) annually in 2014 (including emissions from both land use change and forestry sector)[10]. Emissions have shown a steady increase since the 2000s, and are projected to increase by 38% by 2040, partly due to industrialization, increased fertilizer use, and population growth. Studies correlate the increase in greenhouse gas (GHG) emissions with population growth and deforestation rates, both of which are at 2.8% (16).

The agricultural sector contributes slightly more than half (52%) of GHG emissions, 74% of which comes from the livestock subsector. Manure left on pastures and enteric fermentation account for 43% and 32% of total livestock emissions, respectively (see infographic below). The crop sub-sector contributes 26% of all agricultural emissions. Synthetic fertilizers and burning of savannah contribute about 37% and 20% of crop emissions, respectively.

Land use change and forestry contribute about 43% of the total emissions. Deforestation levels have increased from 1% in 2010 (17), to 2.8% in 2013, primarily due to population growth (18). Conversion of forest to agricultural land and an increased need for fuel (charcoal production, biomass) have driven this deforestation; wood fuel accounts for almost 90% of the entire national energy budget.

Recognising the above trends and challenges, the Malawian government has put in place ambitious measures to reduce emissions to zero through a range of strategies including 30% reduction in biomass use for fuel, 40% increase in use of electricity, and a 4% contribution by energy by 2050 (19). Malawi's second communication to the United Nations Framework for Convention on Climate Change (UNFCCC)



10 Carbon dioxide equivalent is a term for describing different greenhouse gases in a common unit.

identifies target areas such as improved rice cultivation practices, improved animal husbandry, improved manure management, promotion of zero tillage, promotion of agro-forestry, reforestation, and afforestation; and treatment of waste. Malawi is yet to invest in efficient greenhouse gas stocktaking, especially for the agricultural sector to facilitate improved mitigation planning.

Challenges for the agricultural sector

Despite growth in agricultural GDP and governmental expenditure in the agriculture sector, agriculture in Malawi faces important biophysical and socio-economic challenges that have hindered poverty reduction and employment creation[11]. Low productivity remains the biggest challenge to the sector, and persists primarily due to soil degradation. An estimated 29 t/ha of soil are lost annually, largely due to poor agricultural practices and rapid population growth, that has pushed production to marginal areas such as slopes and driven deforestation, both of which increase erosion (20).The northern region (Chipita, Karonga, Nkhata districts) and Phalombe district in the southern region are most susceptible to soil erosion. A majority of the farmers (especially smallholder) use hand-held hoes for cultivation, which not only exposes the soil to erosion but also depletes its nutrients (most of the cultivation using hoes is done happens at a depth of less than 30 cm depth). Use of hoes persists mainly due to limited access to other tools, and lack of awareness of alternative practices such as CA (19) (22). Women farmers suffer from systematically poorer land and land use rights, as well as access to inputs, including irrigation technologies, inorganic fertilizer, and draught power. These factors are major contributors to productivity gaps between men and women managed farms (12). Practices such as crop diversification (though widely recommended in various agricultural policies) are yet to be fully adopted due to biases (on the part of both farmers and government policies) towards maize and tobacco mono cropping. Mono cropping has negative impacts on biodiversity, and increases the risk of diseases and pests.

The high dependence on rain fed agriculture makes production susceptible to the vagaries of climate. Climate vulnerability is aggravated by low levels of farmer adaptive capacity. For instance, current small-scale irrigation schemes benefit only 3.3% of rural farming households (23). Only 35% of farmers own land due to land tenure security challenges. Insecure tenure limits access to credit. Lack of credit is strongly associated with low adoption of practices that can enhance resilience.

Weak coordination between actors in the agriculture sector has resulted in inefficient implementation of agricultural policies and climate smart interventions. Extensive synergies between government, the private sector, and NGOs are lacking[12] resulting in inadequate access to financial and extension services, particularly for smallholder farmers (following liberalization of the agricultural sector)[13]. The ASWAp and the VUNA[14] program represent deliberate policy and institutional efforts to address the coordination issue. However, effective coordination remains a major constraint. An effective platform for knowledge sharing, co-financing, and joint project implementation, along with structures to more effectively engage the private sector, could prove useful.

Poor access to agricultural markets, especially for smallholder farmers, not only reduces market participation and commercialization, but is also a disincentive for farmers to adopt improved technologies. For instance, only 15% of total produce goes to the markets, with the remainder used to meet household food requirements. Given limited storage technologies, this aggravates post-harvest losses. Poor infrastructure (only 26% of the roads are paved) and price volatility are some of the major barriers to market access. Poor farmer organization significantly reduces farmer bargaining power and leads to asymmetries in access to market information. In addition, government policy has had detrimental impacts on agricultural markets in the recent past. For instance, the soy bean export ban is estimated to cause a 56% loss to farmers' revenue each year year (24). Maize export bans are also responsible for high price instability and the majority of food crises in Malawi (Ibid).

Agriculture and climate change

Eighty percent of people in Malawi depend on rain-fed agriculture. This makes the sector (and the economy at large) very vulnerable to climate change (25)(26). Economic growth tends to follow growth in agriculture. For instance, there was a significant fall in GDP in 2015 following the 2015 floods (13). The impact of drought (which tends to recur every 5 to 25 years) on the agriculture sector is estimated at 1.1% to 21.5% (Ibid).

Historical data for the last four decades indicates that the climate has been highly variable, and the weather very unpredictable. Droughts and floods are considered to have become have become more frequent. The water levels in Lake Malawi have been fluctuating, which can be attributed to temperature increase and decline in rainfall. Mean annual temperature increased by 0.9 °C between 1960 and 2006 (26).

The most common hazards include seasonal droughts, intense rainfall, and floods. The floods of 2015 resulted in losses estimated at USD 335 million, while a drought that followed in 2016 resulted in an estimated loss of USD 365 million. Significant losses due to extreme weather events were also witnessed in 2005 (estimated at USD 900

11 Most of these challenges have been highlighted in a number of government documents such as (e.g. the ASWAp and the National Agriculture Policy among other government documents).

12 More discussion on coordination challenges is in the institutions section.

13 Liberalization of agriculture policy includes reduction (abolishment) of government control on input and output markets and commercialization of parastatals.

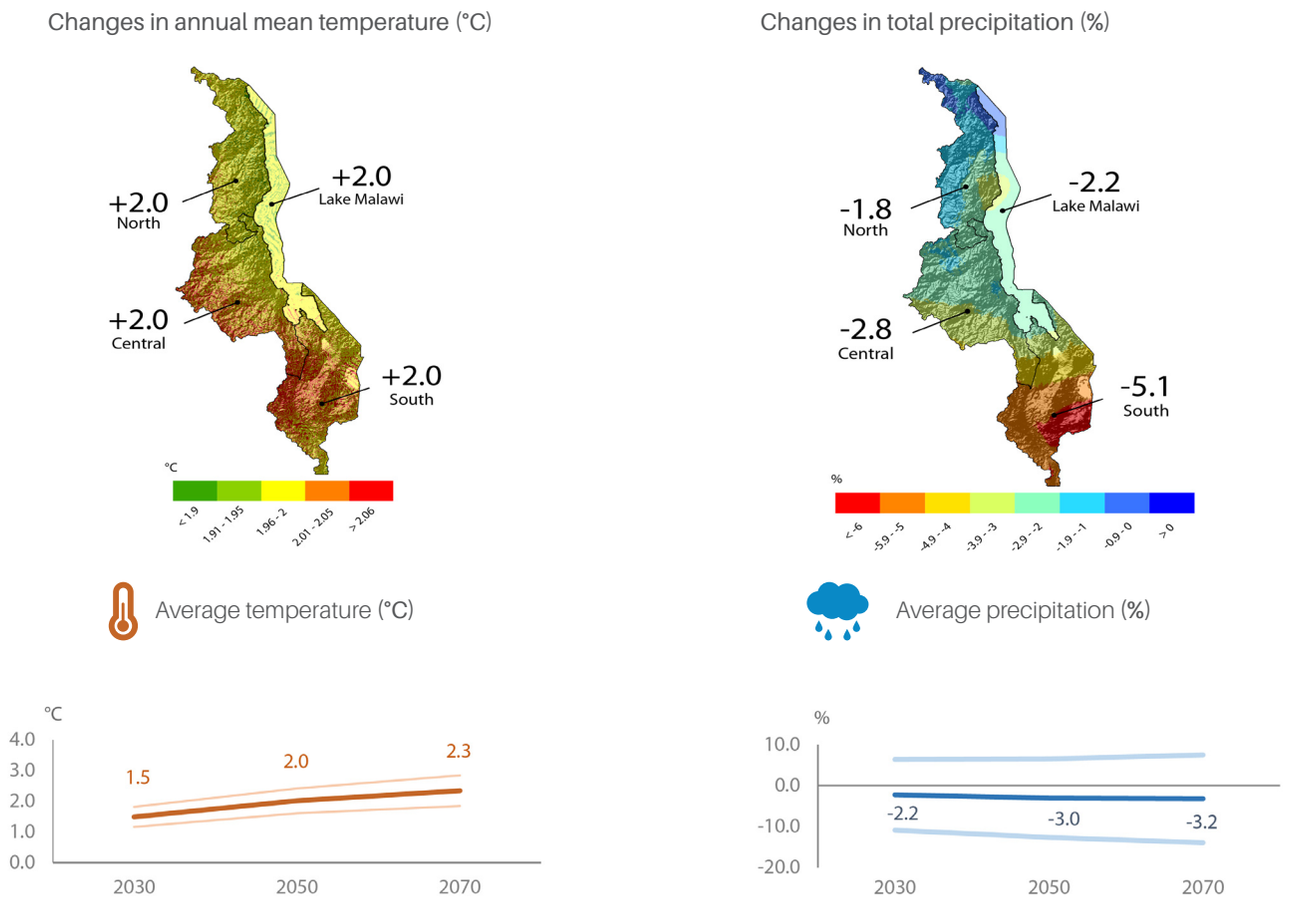
14 VUNA is a Swahili word, which means harvest. More details about the program are available at: http://www.vuna-africa.com/about-vuna/

million), 2004, 1999 and 1992 (25). The costs of investing in adaptation measures are much lower over the longer-term when compared to the extensive losses.

The direct effects on the agriculture sector include significant declines in output, and concomitant price spikes for most food commodities[15]. Droughts are estimated to increase poverty levels by 1.3 percentage points (pp), and generate losses of on average 4.6% for maize, the primary food crop (23). This high climate vulnerability is aggravated by limited alternative livelihood options and low governmental budgetary allocations for climate resilience and adaptation. Vulnerability is not uniform as some areas in the Southern region experience floods, while other areas along the Lakeshore Plain (e.g. Karonga) experience droughts. There is a need for a mix of strategies and interventions customized to the vulnerabilities in each area/region[16].

Future projections show with significant confidence and agreement that temperatures are likely to increase by 1.5 °C, 2 °C and 2.3 °C by 2030, 2050, and 2070, respectively (see maps below). These findings are comparable to findings of the World Bank, the Government of Malawi (2011), and UMFULA (16) (26) (27). Such warming is more likely in the central and southern regions. Projections for annual rainfall are less conclusive; some models show a decrease by 2070, while others show an increase. The average from all the models suggests decreases of 2.2%, 3.0% and 3.2% in 2030, 2050, and 2070 respectively (26) (9) (16). The reduction in rainfall is likely to be more pronounced (-5.1%) in the southern region than in the north (-1.8%). Despite the inconsistency in the future trends in rainfall patterns, there is a general agreement that rainfall is likely to become increasingly variable, with increased risk of above-normal rainfall resulting in floods, but also more dry days per year. Such changes are likely to have detrimental effects on the agricultural sector, including reducing the area suitable for agricultural production. More pronounced warming and reduction in rainfall in the southern region makes it particularly vulnerable.

Projected change in Temperature and Precipitation in Malawi by 2050 [33, 34, 35]



15 Estimation of the costs of climate change is partial, since not every aspect is captured in current measurements

16 The Malawi Vulnerability Assessment Committee (MVAC) provides annual reports on the food insecurity situation, including impacts from extreme weather events in Malawi.

Potential economic impacts of climate change

The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) has been used to analyze the effects of climate change on agriculture in Malawi over the period 2020-2050[17] (31). This assessment considered three parameters, namely: net trade[18], crop area (livestock is not included in this analysis), and yields[19], for scenarios with and without climate change (CC and NoCC). All commodities were assessed individually. An assessment for tobacco was not possible due to unavailability of data. The effects are reported as percentage points (pp) illustrating differences between the percent changes between the two scenarios (considering 2020 as the baseline year and 2050 as the end year)[20].

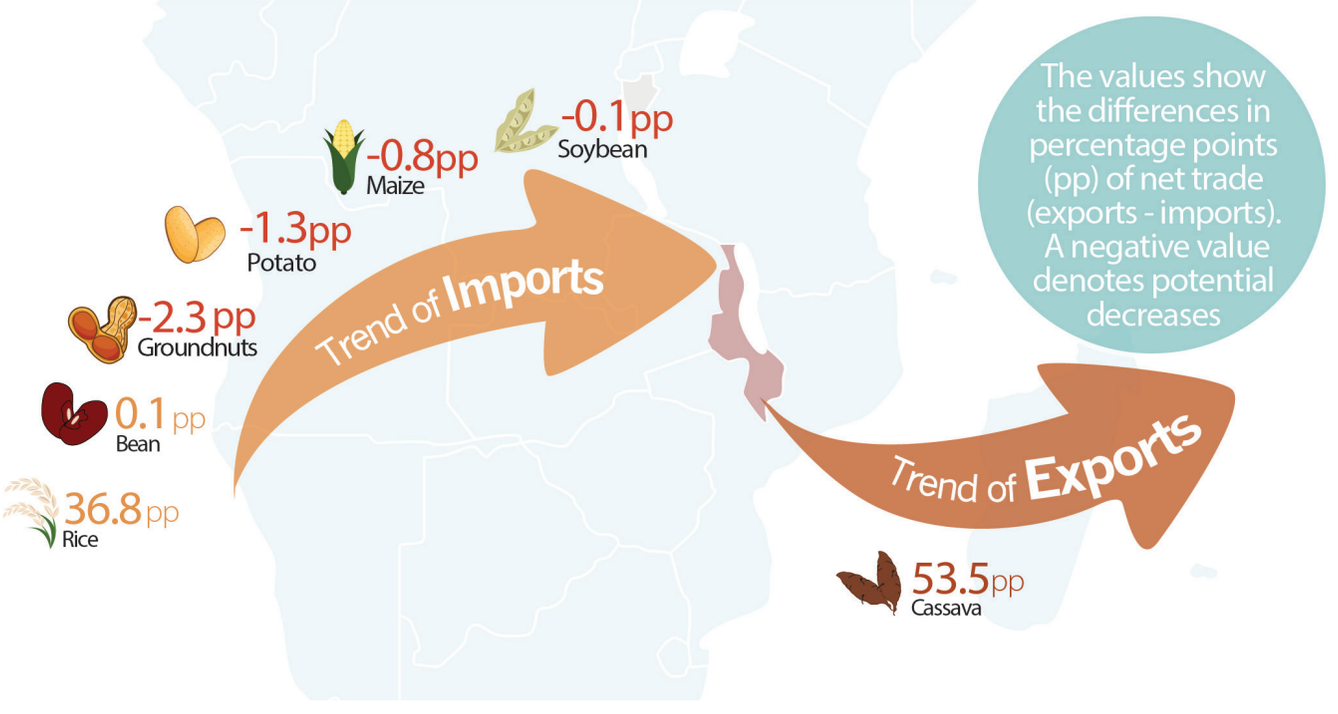
Independent of climate change, the results show that Malawi will likely become more dependent on imports of most food commodities, in particular maize, rice, groundnut meal, soybean meal, beans, and potato. The results also indicate that:

- Climate change is likely to reduce potato, groundnut, and maize imports by 1.3 pp, 2.3 pp and 0.8 pp respectively.
- Imports for rice are likely to increase by 36.8 pp under CC. This may not necessarily arise from the direct adverse effects of climate change on rice; supply and demand for other commodities are also important factors.
- Cassava exports are likely to increase by 53.5 pp under both CC and NoCC scenarios.
- Rice and pigeon pea will require special policy attention given the likely increase in imports for the former and a significant decrease in the exports of the latter. This presents opportunities for easing international trade of rice, and a shift of attention (in terms of incentive to produce) from pigeon pea to other commodities in where Malawi may have a better competitive advantage.

Looking at the potential changes in yields and harvested areas, different outcome likelihoods emerge for different crops. The following changes in crop area under cultivation are projected by 2050:

- The areas under rice and groundnut production are likely to increase by 6 pp and 7.6 pp under the CC and NoCC scenarios, respectively. This suggests that

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



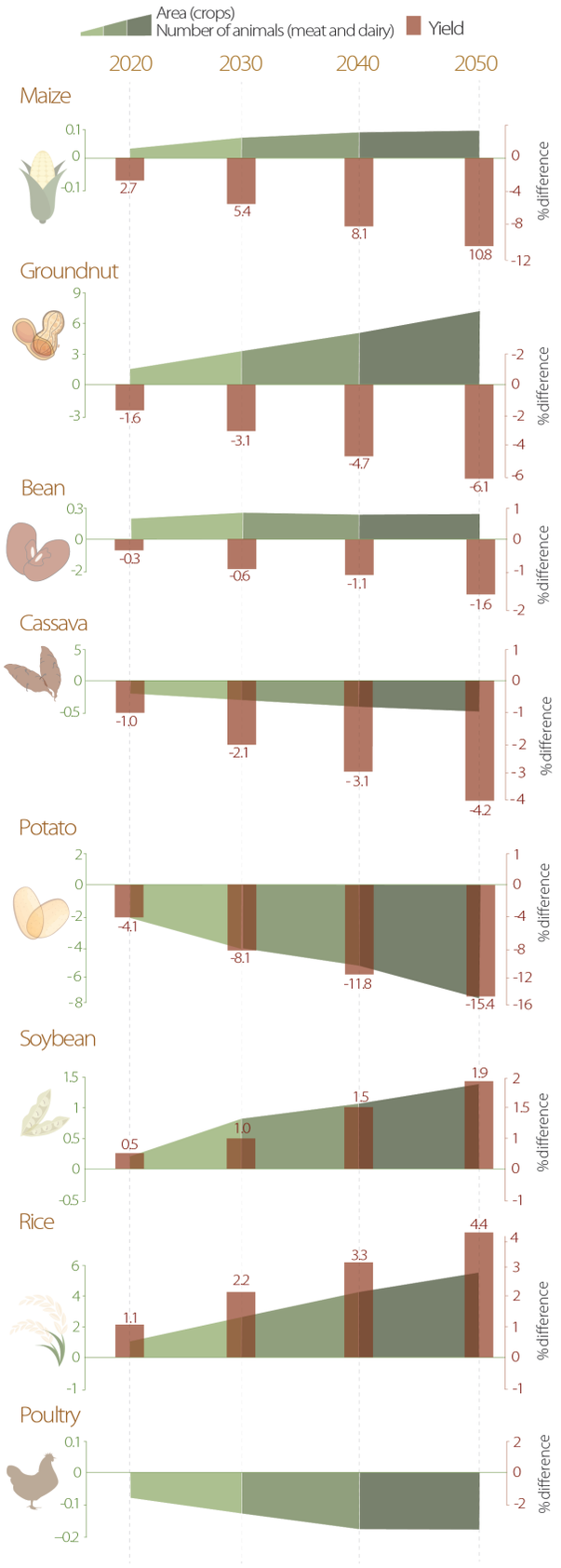
17 The IMPACT Model was parameterized by the Second Shared Socioeconomic Pathway (SSP2), a conservative scenario that is typically considered "business-as-usual".

18 A positive value for net trade indicates greater exports than imports while a negative value for net trade indicates greater imports than exports. Ideally, countries strive to have positive net trade of key agricultural commodities.

19 Measured in tonnes/ ha

20 The infographic on yields, crop area and animal numbers show changes in percentages.

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



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

changes in precipitation and temperatures associated with climate change may favor production of these crops

- The area under soybean cultivation is likely to decrease under both the CC and NoCC scenarios. This decrease is projected to be slightly smaller (<1 pp) under CC compared to the NoCC scenario. This indicates that there are other factors in addition to climate change that may be unfavorable for future production of soybean in Malawi.

- The area under potato and cassava production is expected to decrease under CC relative to NoCC, by 6.34 pp and 0.36 pp, respectively.

- The area under common bean does not reveal a significant difference between baseline and climate change scenarios, suggesting that bean production in Malawi not be adversely affected by climate change (44).

In addition to impacts on crop area, the following can be expected for crop yields:

- Yields for all crops except for soybean and potato are likely to increase to decrease over the period 2020 to 2050 under both CC and NoCC.

- Climate change is likely to reduce the yields of maize, groundnut, beans, cassava and potato by 10.61 pp, 5.84 pp, 1.87 pp, 3.63 pp and 12.78 pp respectively, but increase the yields for rice and soybean by 6.93 pp and 1.33 pp respectively.

For livestock, climate change impacts have been assessed in terms of changes in animal or bird numbers. The results suggest a likelihood of:

- A possible increase in the goat population under both climate change and no CC scenarios. The increase is likely to be higher by 0.3 pp under the NoCC.

- A possible increase in the number for poultry (predominantly chicken) under the NoCC, with a slight decrease of -0.11 pp under the CC scenario. The results suggest that climate change is unlikely to have significant adverse effects on livestock production of goats and poultry.

Most of the crops analyzed are likely to be adversely affected by climate change. The greatest effects will be on yields (especially for maize and potato) and trade (especially for rice and pigeon pea). Blended policy interventions that ease international trade for the impacted crops while simultaneously addressing yield reductions, will foster adaptation and resilience under 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 Country Profile, practices are considered climate smart if they enhance productivity as well as contribute to at least one of the other objectives of CSA (adaptation and/or mitigation).

CSA practices in Malawi fall largely under seven categories, namely: soil management, crop management (which includes use of drought tolerant crop/varieties and crop diversification), water management, livestock management, forestry, fisheries and aquaculture, and energy management (32).

Soil management practices such as Conservation agriculture (CA), agroforestry, improved fertilizer and manure use help improve soil condition by restoring nutrients, water and microbial activities to improve soil health. A number of such practices have been prioritized in the country, under different projects, and in government policy documents (13) (33) (34).

Other CSA practices such as water harvesting and use of efficient irrigation methods (e.g. drip irrigation) help to conserve both water and soil. These have been promoted by the Lilongwe University of Agriculture and Natural Resources (LUANAR), especially via farmer training.

Use of improved varieties (early maturing, drought resistant, high yielding), intercropping, irrigation, and crop diversification, whether used separately, or in combination, are also common adaptation practices in Malawi. For instance, farmers diversify production by planting drought tolerant crops such as root crops (cassava, Irish potato and sweet potato), and dryland cereals (millet and sorghum). However, some of the challenges to diversification include possible reductions in maize yields when maize is grown with other intercrops. Distribution of planting material for sweet potato by the International Potato Center (CIP) and other partners helps farmers to access improved varieties after floods and drought. Rapid multiplication of planting material under irrigation in the dry season also promotes farmers' access to planting material.

Agroforestry (which involves fertilizer-, fruit-, and fuelwood and fodder trees) is an important practice in Malawi, which benefits both livestock and crops and iscan be a source of income (depending on the planted trees). The commonly planted legume species include Faidherbia albida, Sesbania sesban, Gliricidia sepium, Cajanus cajan and Tephrosia vogeli. Agroforestry shrubs are mostly intercropped with annual food crops such as maize to improve soil cover, improve organic matter, improve water infiltration and help control soil erosion (29), while tobacco farmers use agroforestry trees a shade trees.

Conservation agriculture (CA) is one of the most widely promoted CSA practices in Malawi, accounting for over 78% of all the CSA projects running in the country[21]. The practice is based on minimum soil disturbance to maintain organic matter in the soil. The practice is commonly promoted alongside other practices such as use of quality seed, organic and chemical fertilizers, and herbicides to maximize yields. However, despite efforts to promote adoption of CA, only about 1.7% of the total arable land is under CA. The major barriers to CA adoption include limited knowledge about the practice (due to weak extension delivery) and lack of consideration of farmers' preferences. Such barriers have resulted in low uptake and conflicting messages about the practice[22]. For example, some organizations limit CA to just use of herbicides, hence farmers never use any CA practice for lack of herbicides. Low adoption of CA is more pronounced among women farmers particularly due to limited access to land (for practices such as crop rotation) and lack of relevant equipment (most of the farmers use pointed sticks when planting into the residues). Research by some NGOs claims that CA can reduce the labor demand for women farmers by about 34 days[23].

Integrated soil fertility management (ISFM) is another important practice in Malawi used to address soil loss and prevent macro- and micro-nutrient deficiencies in soils. Soil loss contributes to about 1.6% GDP loss in Malawi (35). ISM involves the use of agroforestry, incorporation of organic matter (mulch, compost, crop residue, and green manure), and inorganic fertilizer. High inorganic fertilizer prices are one of the motivations for using organic matter (farmers never substitute the two, but due to the high prices for inorganic fertilizer, they only use organic fertilizer when it is readily available). The Farm Input Subsidy Program (FISP) seeks to address the issue of high prices for inorganic fertilizers. Access to inorganic fertilizer and the FISP has partly enhanced the use of improved seed varieties that are more resilient to weather variations, more efficient in water and nutrient utilization and have higher yields. Sixty five percent of all the CSA related projects in Malawi promote use of improved seed varieties (33).

Despite the potential that CSA practices have to increase resilience (increase and diversify farm incomes and reduce production shocks) during extreme weather events, adoption of CSA practices remains low. Indeed, dis-adoption and partial and partial adoption of some CSA practices is common.

Lack of secure land tenure is also a major hindrance to adoption of CSA practices especially those CSA requiring

21 Institutions promoting CA in Malawi include the Ministry of Environment and Climate Change, Department of Research, NASFAM, Total Land Care, World Vision, Civil Society for Agriculture Network and Farmer Union of Malawi (FUM) among others. There is also a National Conservation Agriculture Taskforce, chaired by the FUM.

22 National Guidelines has been prepared to minimize the problem of conflicting messages on CA.

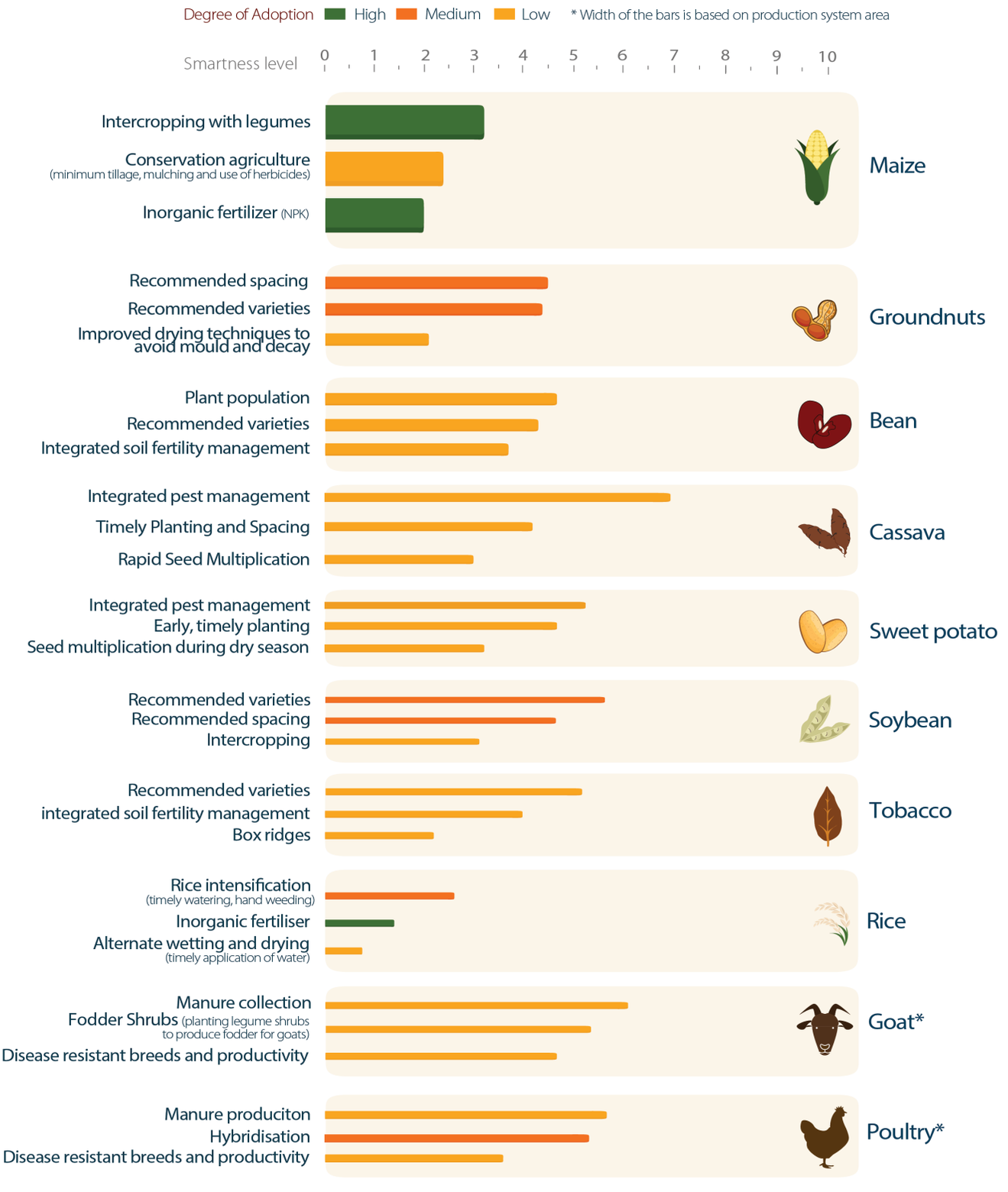
23 https://www.concern.net/sites/default/files/media/page/conservation_agriculture_and_women.pdf https://www.concern.net/sites/default/files/media/page/conservation_agriculture_and_women.pdf

high initial cost, or that have a long lag time (time before benefits are realized). Weak extension services to farmers also impede CSA practice adoption, and is a major contributing factor for low productivity. Evidence suggests that smallholder farmer yields in Malawi could potentially double if farmers had access to the knowledge and training they need (36). There is also a gap in research to provide evidence (in different areas and contexts in the country) of the benefits and constraints of adopting CSA practices.

Despite the barriers, opportunities exist for scaling out adoption of CSA practices in Malawi. According to the CSA Investment Proposal (37) an opportunity lies in improving farmers' access to accurate and timely weather and market information, inputs, credit and extension services. Redress of the existing land issues, improvement of infrastructure, establishment of a common national platform for CSA, harmonization of the policies relating to CSA, and enhanced funding and research supports are important enablers. This can be enabled by politicians taking decisions for the greater good) and by the economy growing and diversifying ('mkaka ndi uchi'). Consideration of indigenous and farmer knowledge and widening the scope beyond CA also has potential to enhance CA adoption.

The following graphics present a selection of CSA practices with high climate-smartness scores in Malawi according to evaluations gleaned in a national expert workshop(2018). The average climate smartness score is calculated based on the CSA 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 100% change (positive/ negative) and 0 indicating no change. The CSA practices in the graphic have been selected for each production system considered key for food security. Annex 2 provides a detailed explanation of the methodology.

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



** Unidentified production system area

Case study 1: Enhancing Community Resilience to Climate Change and Variability

Poverty reduction among smallholder farmers in an uncertain climate (characterized by highly variable and unpredictable weather, and prolonged and frequent extreme weather events) has remained a major problem in not only Malawi, but in most developing countries. This has instigated the need for interventions that can simultaneously and sustainably address all facets of poverty (including vulnerability, low adaptive capacity, and food insecurity) among smallholder farmers. However, interventions considering all these dimensions are complicated and more difficult to implement and coordinate. Most interventions have a narrow scope and are consequently minimally successful in increasing climate resilience.

The Enhancing Community Resilience to Climate Change and Variability Project (ECRP) aimed at reducing poverty and hunger in Malawi. The ECRP was a 5-year project ending in 2016, and was funded by the United Kingdom's Department of International Development (DFID), and the Governments of Ireland (Irish Aid) and Norway (Norwegian Embassy Malawi). The ECRP was implemented by Christian Aid and Concern Universal in 11 disaster-prone districts in Malawi[24]. The project focused on 4 major impact areas: increasing capacity of local authorities, communities, and farmers to address the impacts of climate change; increasing adaptive capacity of both communities and individuals; increasing information sharing by various stakeholders on disaster risk management; and strengthening early warning systems for climate-related disasters.

Evaluation of the project showed significant success including:

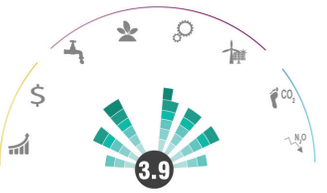
- The number of households aware of climate change increased by 59,260.
- 155 more group village headmen had functioning early warning systems.
- 27,707 households had access to seasonal and short-term climate and weather forecasts.
- The number of individuals using a combination of at least two CSA techniques (irrigation, CA and drought tolerant crops) increased by 166,522.
- Adoption of energy efficient cook stoves and solar increased by 77,768 and 14,945, respectively.
- 1,852,409 more trees were planted.
- Individuals participating in Village Savings and Loans Associations (VSLAs) increased by 31,577.
- Food security more than doubled (the number of families that have their own food supply for more than 9 months of the year increased from 15% to 35%).
- Average household incomes doubled.
- Asset bases increased by 151.
- The number of policy makers using evidence from ECRP increased from 24% to 85% from 2012 to 2014.

In addition, through the ECRP programme, members of the Malawi Vulnerability Assessment Committee received training that enabled the Committee to better conduct the country's annual food situation and market assessments, and disseminate results to government and development partners. The information on the assessment reports informed development of a number of programmes in the country. A number of policy briefs and lesson learning papers were developed by the Centre for Environmental Policy with Advocacy and over 94% of stakeholders indicating satisfaction with the policy briefs and learning papers.

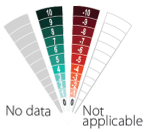
The success of the programme is attributed to successful engagement of all relevant stakeholders, especially the private sector and beneficiaries, throughout the whole period of the project, as well as prioritization of the most important limiting factors to adoption of climate smart practices by farmers (e.g. knowledge and information access, financial services access, off-farm services access). Such approaches can potentially be replicated in other projects that aim to increase productivity and food security in a highly variable and changing climate.

24 More details are available at: https://devtracker.dfid.gov.uk/projects/GB-1-201196/documents

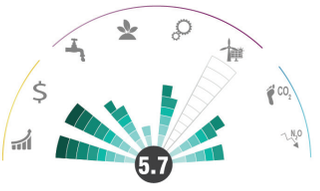
Table 1. Detailed smartness assessment for major ongoing CSA practices by production system as implemented in Malawi.

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				
Conservation agriculture (minimum tillage)	Lower Shire (Chikwawa, Nsanje) <30%	S		**Productivity** Increases yield and income at household level. **Adaptation** Improves soil structure, improves water conservation, and reduces the use inorganic fertilizer. **Mitigation** Reduces carbon emissions due to reduced use of fertilizer. However, use of poor quality manure can increase carbon emissions.
	Central region (Lilongwe, Dowa, Ntchinsi, Kasungu, Dedza, Salima) <30%	S		
Crop rotations (with legumes and winter wheat)	Lower Shire (Chikwawa, Nsanje) >60%	S M		**Productivity** Increases yields and reduces post-harvest losses. **Adaptation** Reduces the use of fertilizer, diversifies farm incomes, and improves resilience through promotion of moisture retention and conservation. **Mitigation** Reduced emissions via leguminous nitrogen fixation.
	Central region (Lilongwe, Dowa, Ntchinsi, Kasungu, Dedza, Salima) >60%	S M L		
Rice				
Rice intensification	Lake Shore (Mangochi, Salima, Karonga), Lower Shire (Nsanje) 30-60%	S M L		**Productivity** Increases yields and incomes. **Adaptation** Reduces the use of fertilizer and improves water use efficiency. **Mitigation** Increases GHG emissions.
	Lake Shore (Zomba, Phalombe, Salima, Karonga) 30-60%	S M L		

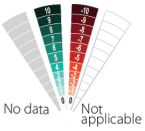
CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Rice				
Inorganic fertilizer (NPK)	Lake Shore (Mangochi, Salima, Karonga), Lower Shire (Nsanje >60%	S M L		**Productivity** Increases yields and hence incomes. **Adaptation** Improves food security due to improved yields. **Mitigation** Can contribute to carbon sequestration when applied in the correct quantities and combinations.
	Lake Shore (Zomba, Phalombe, Salima, Karonga) >60%	S M L		
Poultry				
Hybridisation	Lower Shire and along Lake shore (Chikwawa, Nsanje, Salima, Nkhotakota, Mangochi, Balaka) <30%	M		**Productivity** Increases yields and income. **Adaptation** Enhances disease resistance, increases food and nutrition, improves soil fertility. **Mitigation** May increase GHG emissions
	Central and Northern regions (Thyolo, Blantyre and Mulanje) <30%	M L		
Manure production and use	Lower Shire and along Lake shore (Chikwawa, Nsanje, Salima, Nkhotakota, Mangochi, Balaka) <30%	S		**Productivity** Increases yield over time. **Adaptation** Improves soil quality, and improves food security and livelihoods. **Mitigation** Can contribute to emissions if not managed well.
	Central and Northern regions (Thyolo, Blantyre and Mulanje) 30-60%	S M L		



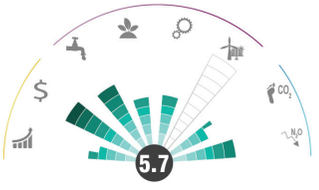
Yield Income Water Soil Risk/Information Energy CO_2 Carbon N_2O Nutrient

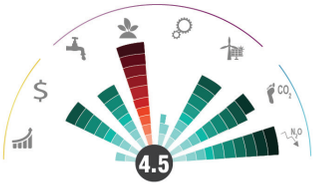
CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Goats				
Fodder shrubs	Dedza, Mulanje, Blantyre, Mzimba 30-60%	S M		**Productivity** Improves yields, and hence income. **Adaptation** Controls soil erosion and soil loss, reduces incidences of disease and increases biodiversity. **Mitigation** Increases biomass, and hence enhances carbon sequestration.
	Chikwawa and Nsanje <30%	S M L		
Manure collection and application	Dedza, Mulanje, Blantyre, Mzimba 30-60%	S M		**Productivity** Increases yields hence income. **Adaptation** Improves soil quality, enhances food security and livelihoods. **Mitigation** Can contribute to emissions if not managed well.
	Chikwawa and Nsanje <30%	S M L		
Potato				
Early timely planting	Lower Shire (Chikwawa, Nsanje, Neno) <30%	S		**Productivity** Increases yields. **Adaptation** Cushions the farmers from droughts and improves food security. **Mitigation** Enhances carbon sequestration as it ensures vegetation cover.
	Dedza, Ntcheu <30%	S		

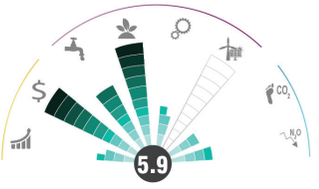
CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Potato				
Integrated pest management	Lower Shire (Chikwawa, Nsanje, Neno) <30%	S		**Productivity** Increases yields and incomes. **Adaptation** Improves pest and disease resistance, and improves food security. **Mitigation** Enhances soil carbon sequestration.
	Dedza, Ntcheu <30%	S		
Cassava				
Timely planting and proper spacing	Lake shore (Balaka) 30-60%	S M		**Productivity** Increases yields and incomes **Adaptation** Increases food security. **Mitigation** Increases carbon sequestration in plant matter and soil
	Lakeshore (Nkhotakota, Nkhatabay) 30-60%	S M		
Integrated pest management	Lake shore (Balaka) <30%	S		**Productivity** Increases productivity hence incomes. **Adaptation** Enhances food availability. **Mitigation** Increases carbon sequestration in plant matter and soil.
	Lakeshore (Nkhotakota, Nkhatabay) <30%	S		

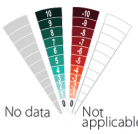


Yield Income Water Soil Risk/Information Energy CO_2 Carbon N_2O Nutrient

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
Soy bean				
Rotational grazing	Southern region (Chikwawa, Nsanje, Blantyre, Mwanza, Balaka) 30-60%	M L		**Productivity** Increases yields and incomes. **Adaptation** Reduced pest and disease incidences, increased nitrogen fixation, and improved nutrition and food security. **Mitigation** Enhances vegetative cover and facilitates carbon sequestration.
	Central region (Dowa, Lilongwe, Kasungu, Ntchisi, Mchinji, Ntcheu, Dedza) 30-60%	M L		
Using recommended spacing (crop population management)	Southern region (Chikwawa, Nsanje, Blantyre, Mwanza, Balaka) 30-60%	S M L		**Productivity** Increases yields and incomes. **Adaptation** Reduces degradation of soils, reduces soil erosion, and enhances vegetative cover and biodiversity. **Mitigation** Enhances water conservation, pest and disease control, and nutritional security.
	Central region (Dowa, Lilongwe, Kasungu, Ntchisi, Mchinji, Ntcheu, Dedza) 30-60%	S M L		
Groundnuts				
Using recommended and improved varieties	Southern region (Chikwawa, Nsanje, Blantyre along the shire, Mwanza, Balaka) 30-60%	M L		**Productivity** Increases yield and incomes. **Adaptation** Enhances tolerance to drought, pest and disease control, and food security. **Mitigation** Can enhance carbon sequestration.
	Central region (Dowa, Lilongwe, Kasungu, Ntchisi, Mchinji, Ntcheu, Dedza) 30-60%	M L		

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
Groundnuts				
Using recommended spacing of planted crops	Southern region (Chikwawa, Nsanje, Blantyre along the shire, Mwanza, Balaka 30-60%	S M L		**Productivity** Increases yields and incomes. **Adaptation** Enhances disease and pest control. **Mitigation** Can contribute to the reduction of carbon emissions.
	Central region (Dowa, Lilongwe, Kasungu, Ntchisi, Mchinji, Ntcheu, Dedza) 30-60%	S M L		
Tobacco				
Integrated soil fertility management	Lakeshore areas, Shire valley (Karonga, Salima, Nkhotakota, Machinga) <30%	S		**Productivity** Increases yields. **Adaptation** Improves soil properties and enables reduced fertilizer use. **Mitigation** Can contribute to reduction of GHG emissions.
	Kasungu, Lilongwe, Mchinji, Dowa, Mzimba, Rumphi, Chitipa, Thyolo >60%	S M L		
Recommended varieties (improved varieties)	Lakeshore areas, Shire valley (Karonga, Salima, Nkhotakota, Machinga) <30%	S		**Productivity** Increases yields and incomes via resistance to pests and diseases. **Adaptation** Increased to weather variations and enhanced disease and pest control. **Mitigation** Can contribute to reduction in emissions.
	Kasungu, Lilongwe, Mchinji, Dowa, Mzimba, Rumphi, Chitipa, Thyolo >60%	S M L		

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
Beans				
Using recommended (improved varieties)	Lilongwe, Kasungu, Mzimba, Rumphi, Zomba, Phalombe, Thyolo <30%	S M		**Productivity** Increases yields and incomes. **Adaptation** Enhances tolerance to weather variations, diseases, and pests. **Mitigation** Can contribute to reduction in emissions.
	Mchinji, Dedza, Ntcheu, Dowa, Ntchisi, Highlands (Jenda, Mzuzu, Nyika, Misuku hills, Chiradzulu, Thyolo, Mulanje, Livingstone mountains) >60%	S M L		
Recommended spacing of planted crops	Lilongwe, Kasungu, Mzimba, Rumphi, Zomba, Phalombe, Thyolo <30%	S M		**Productivity** Increases yields. **Adaptation** Reduces time and labor in weeding; particularly relevant to women, who are primarily responsible for bean crops. **Mitigation** Can reduce emissions due to reduced tillage, better leaf development, and reduced use of herbicides.
	Mchinji, Dedza, Ntcheu, Dowa, Ntchisi, Highlands (Jenda, Mzuzu, Nyika, Misuku hills, Chiradzulu, Thyolo, Mulanje, Livingstone mountains) >60%	S M L		



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

Institutions and policies for CSA

Well-functioning institutions have a critical role to play in enabling rural communities to adapt and be more resilient to climate change (22) (38). Over 70 institutions (government, non-government, private, and farmers organizations) are involved (individually or as alliances and/or taskforces) at different levels in CSA and related interventions in Malawi[25].

The Ministry of Agriculture, Irrigation and Water Development (MoAIWD) and its seven focus Departments which include the Department of Agriculture Research Services (DARS), Department of Agricultural Extension Services (DAES), Department of Forestry, the Land Resource Conservation Department (LRCD), and Department of Disaster Management Affairs (under the office of the Vice President) among others play major roles in provision of off-farm services such as weather forecasting, and diffusion of new production technologies. The DARS leads agriculture research in the country, and facilitates development, dissemination (together with the DAES) and adoption of CSA technologies through its network of extension workers (39). DARS also collaborates with partners from the Consultative Group on International Agriculture Research (CGIAR) and NGOs such as Concern Universal, CARE Malawi, and World Vision International.

The LRCD is mandated to ensure sustainable utilization of land based natural resources (not limited to agriculture), and is the focal point for CSA in the Ministry. LRCD works together with other actors and CSA platforms in coordinating CSA investments in Malawi. Examples of field programmes the department is undertaking include soil and water conservation, rainwater harvesting, agroforestry and soil fertility management, and CA. LRCD also takes part in implementation of donor-funded projects such as the ASWAp Support Project and the Shire Valley Irrigation Project, among others.

The Environmental Affairs Department (EAD) and Department of Climate Change and Meteorological Services (DCCMS), under the Ministry of Natural Resources, Energy and Mining (MNREM), is the focal national point for climate change in Malawi, with responsibility for creating awareness and providing policy directions for climate change adaptation and mitigation.

A number of civil society organizations (CSOs) also contribute to implementation of climate change programmes, policy analysis, and advocacy. The Civil Society Network on Climate Change (CISONECC) is a major player in this arena. CISONECC is composed of over 41 NGOs and CSOs, and is a member of the Southern Voice of Adaptation[26]. CISONECC has influenced formulation of a number of policies relating to climate change in the country, including the National Disaster Risk Management and National Climate Change Policies.

The Root and Tuber Crops Development Trust (RTCDT) aims to promote nutrition security through strengthening the root and tuber crop value chains with a focus on cassava, Irish potato, and sweet potato. These crops are more resilient to adverse weather conditions and can produce substantial yields when maize fails. Consequently, they have significant potential to reduce nutritional vulnerability. The RTCDT links relevant stakeholders across the value chains, develops technologies such as high yielding varieties and promoted bio fortification for improved nutrition, and promotes access to planting materials. Such efforts have resulted in significant increase in the yields of these tuber crops.

Faith-based organizations such as the Evangelical Association of Malawi, Catholic Relief Services, and the ACT Alliance (composed of Christian Aid, Danish Church Aid, and Evangelical Lutheran Development Services) promote adoption of CSA practices such as crop diversification, use of improved varieties, and irrigation. They also promote afforestation and use of energy-saving cook stoves. Christian Aid engaged in the 2017 implementation of the ECRP[27]. CRS, in partnership with the National Smallholder Farmers' Association of Malawi, is implementing the USAID-funded United in Building and Advancing Life Expectations (UBALE) project.

Research institutions working on CSA and climate change include the International Potato Center (CIP), International Institute of Tropical Agriculture (IITA), International Center for Tropical Agriculture (CIAT), International Centre for Research on Agroforestry (ICRAF), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and International Maize and Wheat Improvement Center (CIMMYT). CIAT and ICRISAT have worked on development and dissemination of improved bean and groundnut varieties that are tolerant to climate shocks, while CIP has promoted the orange-fleshed sweet potato as a drought-resistant alternative. ICRAF promotes agroforestry and CA, while CIMMYT disseminates drought-tolerant maize varieties, in addition to promoting CA. These international research institutions work closely with DARS, national universities such as the Lilongwe University of Natural Resources (LUANAR) and Mzuzu University, and in collaboration with international universities and research institutions.

Farmer organizations such as the Farmer Union of Malawi and NASFAM also promote CSA in Malawi through policy advocacy and lobbying for smallholder farmers, along with promotion of improved varieties, crop diversification, commercialization of agriculture, and value addition. NASFAM is the lead partner for promotion of CA by the CSA Alliance. The CSA Alliance is composed of the MoAIWD, World Vision International (WVI), the Food and Agriculture Organization (FAO) and Concern Worldwide, and assumes responsibility for coordination of CSA at the national level.

Despite the strong presence of institutions working towards promoting CSA practices in Malawi, the impacts to date have

25 Taken together, approximately 14% of the projects undertaken by all of the aforementioned institutions can be classified as CSA (33).

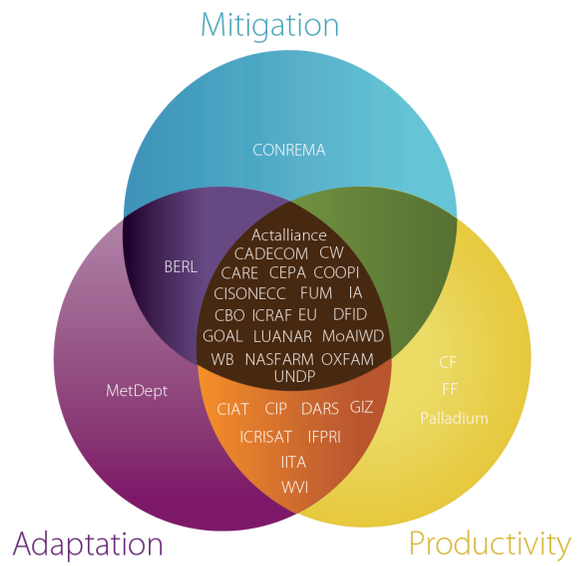
26 For more information on Southern Voice of Adaptation see this link: http://www.southernvoices.net/en/

27 See case study in this document for additional detail on ECRP.

been limited. This may be attributed to weak coordination and collaboration across the different organizations, alliances, and taskforces. For instance, there are separate taskforces for rainwater harvesting, agroforestry, irrigation, and CSA, resulting in considerable duplication of effort. Most of the institutions are working in isolation, which has handicapped efforts to gain efficiencies and increased impact. Strong opportunity exists for coordination, harmonization and use of common data and evaluation protocols for measuring success and impacts. This could help address the challenge of conflicting messages regarding impacts of CA (40) (33). Lack of targeted financial resources is an important impediment to collaboration. This is of particular concern for government institutions, and has resulted in peripheral involvement of key institutions in the implementation of CSA.

The following graphic highlights the key institutions whose main activities relate to one, two or three of the CSA pillars (adaptation, productivity and mitigation)[28]. More information on the methodology is available in Annex 3.

Institutions for CSA in Malawi



BERL Bio Energy Resources Limited **CADECOM** Catholic Development Commission in Malawi **CBO** Community Based Organisations **CEPA** Centre for Environmental Policy and Advocacy **CIAT** International Centre for Tropical Agriculture **CIMMYT** International Maize and Wheat Improvement Center **CIP** International Potato Centre **CISONECC** Civil Society Network on Climate Change **CW** Concern Worldwide **CONREMA** Cooperation Network for renewable Energy in Malawi **COOPI** Cooperazione Internationale **DARS** Department of Agricultural Research Services **DFID** Department for International Development **EU** European Union **FUM** Farmers Union of Malawi **GIZ** German Development Agency **IA** Irish Aid **ICRAF** The World Agroforestry Centre **ICRISAT** International Crops Research Institute for the Semi-Arid Tropics **IFPRI** International Food Policy Research Institute **IITA** International institute of Tropical Agriculture **LUANAR** Lilongwe University Of Agriculture and Natural Resources **MetDept** Climate Change and Meteorological Services **MoAIWD** Ministry of Agriculture, Irrigation and Water Development **NASFARM** National Smallholder Farmers' Association of Malawi **UNDP** United Nations Development Programme **WB** The World Bank Group **WVI** World Vision International

Malawi is a signatory to a number of international policies and conventions on climate change. Malawi signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, and the Kyoto Protocol in 2001. Malawi has submitted its Initial National Communication (INC), its National Adaptation Programmes of Action (NAPA), and its Second National Communication (SNC) in 2002, 2006 and 2011 respectively. In 2015, Malawi also submitted its Intended Nationally Determined Contribution (INDC) that emphasized its commitment to reducing greenhouse gas emissions.

Malawi has a number of national policies, strategies and plans that directly or indirectly address climate change issues. These include Agriculture Sector Wide Approach (ASWAp), the National Energy Policy (NEP), the Environment Policy, and the National Adaptation Programme of Action (NAPA), which constitute a suite of policies that score well in terms of incorporation of climate change (41). Due to the rising awareness of the impacts of climate change (especially on the agricultural sector), several policies such as the National Agriculture Policy (NAP), the Forest Policy (NFP) and the National Irrigation Policy (NIP) have been revised to more coherently include climate change as a consideration for national development. There are also efforts to link the policies to each other for a more holistic approach in addressing climate change. Other policies and frameworks, such as the Strategic Program for Climate Change, the Climate Smart Agriculture Framework, and the CSA Training Manual have been developed to specifically address CSA. Notwithstanding, the existence of policies, Malawi a number of policy objectives regarding climate change resilience. Poor implementation of the policies (aggravated by Ministries and institutions working in isolation) and associated plans is a significant challenge, partly due to lack of financial resources, and partly due to changing regimes in governance.

There remain significant opportunities to more fully address the gender disparities present in Malawian agriculture within the policy framework. Although the National Gender Policy contains a priority area on gender in agriculture, food security, and nutrition, there is a need for decisive implementation and explicit efforts to redress the disadvantage women farmers face in terms of access to resources, education, and extension services.

The following provides an overview of the key policies relevant to CSA and climate change in Malawi.

Vision 2020 (developed in the late 1990s)

- Vision 2020 forms the foundation for almost all policy in Malawi, highlighting the importance of sustainable economic development, improved food security and nutrition, and sustainable natural resource management.

28 The discussion above and the graphic do not include an exhaustive list of all institutions active in the CSA and climate change space in Malawi.

Malawi Poverty Reduction Strategy (MPRSP) 2002

- The MPRSP emphasizes sustainable pro-poor economic growth, redressing access to markets, skills development, creation of employment, and good governance that allows for private and public sector interactions that can benefit the poor.

National Environmental Action Plan (NEAP) 1994 (revised in 2002 to account for decentralization)

- The NEAP focuses on management of soil erosion and fertility, deforestation and over-grazing, management of water resources, air pollution, and climate change. All environmental policies are underpinned by the NEAP.

Malawi Economic Growth Strategy (MEGS) 2004

- The MEGS was intended to fill existing gaps in the MPRSP. It addresses land issues and the relative roles the private and the public institutions play in poverty reduction.

National Environment Policy (NEP) 2004

- The NEP seeks to promote efficient utilization and management of natural resources, increase awareness on the need to promote sound environmental management, and promote rehabilitation and management of essential ecosystems and ecological processes. It incorporates emerging issues to ensure sustainable management of the environment and address gaps identified from the original policy and other frameworks related to the environment.

- The NEP is based on the original National Environmental Action Plan (NEAP) of 1994; the Environmental Support Programme (ESP) operationalized the NEAP.

- The natural resources covered by the NAP includes land, forests and lakes. All of these are important for the agriculture sector as they provide essential inputs. The NAP does not explicitly mention CSA, but puts in place frameworks necessary for promoting CSA in Malawi.

Agriculture Sector Wide Approach (ASWAp) 2010

- The ASWAp framework seeks to increase agriculture productivity to achieve the targeted 6% growth in the agriculture sector. It is a policy tool for operationalizing the Malawi Growth and Development Strategy (MGDS). The ASWAp policy has a number of over-arching priority areas aligned with the Malawi Growth and Development Strategy (MGDS II) such as food security, agro-processing, green belt irrigation, water development, climate change and natural resources.

- In working towards ensuring food security, ASWAp highlights the need to continue the fertilizer subsidy programme to promote maize production. There is evidence that indicates that maize production increased from 1.2 million metric tons in 2004/2005 to 3.4 million metric tons in 2009/2010 (16) (34). Another strategy to increase food security is through promoting on-farm diversification through promotion of more drought-tolerant crops such as sweet potato, cassava, sorghum and millet.

- ASWAp also seeks to address the problem of coordination among implementing institutions for agricultural interventions; borrowing significantly from the decentralization policy. The ASWAp policy also highlights the weak linkages between farmers, government and the private sector. The policy also touches on gender issues in agriculture, the disease burden, resource allocation, and labor productivity.

National Gender Policy (NGP) 2015

- The Gender Policy (2015) aims to ensure that women and other vulnerable groups have access to and control over agricultural productive resources, technologies and markets for cash crops, food and nutrition security.

- The Policy also advocates for more male involvement in food production, storage and preparation. The implementation plan for the agriculture priority in the Gender Policy advocates for women's access to agricultural productive services and resources i.e. markets, market information and technologies as well as gender responsive irrigation technologies.

- Responsibilities are outlined in the implementation plan, but it is unclear how responsibilities and budgets are allocated to different implementing bodies (including the Ministry of Agriculture and Food Security and other ministries, NASFAM, Local Authorities, and NGOs amongest other organisations.

Malawi Growth and Development Strategy I, II and III

- The MGDS I and II seek to increase productivity, diversification, and commercialization. The impacts of MGDS have been called into question, as some Integrated Household Survey human development indicators have deteriorated since its implementation. For instance, the Gini Coefficient at national level has deteriorated from 0.39 to 0.45[29].

- Outcomes of the MGDS include allocation of more than 10% of the budget to the agriculture sector (as outlined in the CAADP). The growth rate for the agriculture sector has fallen just below the 6% goal.

National Irrigation Policy (NIP) 2016

- The NIP is a revision of the 2000 National Irrigation Policy, which relates with other policies such as the National Water Policy (2005), Environment Policy (2004), and the Public Private Partnership Policy (2011). The NIP also addresses emerging issues such as strengthening water users' associations and promotion of public-private partnerships in natural resources management. The NIP also highlights the need for solid coordination.

- Major objectives of the NIP include increasing land

29 This is the commonly used measure of inequality. within a country. The index varies from 0 (complete equality) to 1 (complete inequality).

under sustainable irrigation, crop diversification and intensification, optimization of irrigation development in the face of climate change, and increasing capacity for irrigated agriculture.

National Forest Policy (NFP) 2002 revised 2016

- The NFP seeks to control deforestation and forest degradation, and to increase forest cover by 2% through sustainable management of existing forest resources. It accounts for the National Decentralization Policy (1998) through decentralization of forestry management.

- The revised NFP ensured that the policy connected well with other existing policies such as the National Water Policy (2005), the National Environment Policy (2004), the National Land Policy (2002), and the MGDS II.

National Agriculture Policy (NAP) 2016

- The NAP is a revised version of the 2002 Agriculture Policy. The main aim of the revision was to link all the strategies and policies relating to agriculture as a strategy for achieving food security, increased agricultural productivity and promote sustainable management of land resources. It also seeks to incorporate future challenges to the sector.

- The NAP emphasizes the priorities highlighted in the ASWAp, including irrigation, increased agro-processing, enhanced risk management, strengthened marketing systems, and improved food security and nutrition.

National Climate Change Management Policy (NCCMP) 2016

- The NCCMP seeks to create an enabling policy framework for coordinated approach to climate change management, and environmental degradation.

- It confirms the government's commitment to addressing climate change and vulnerability to climate change.

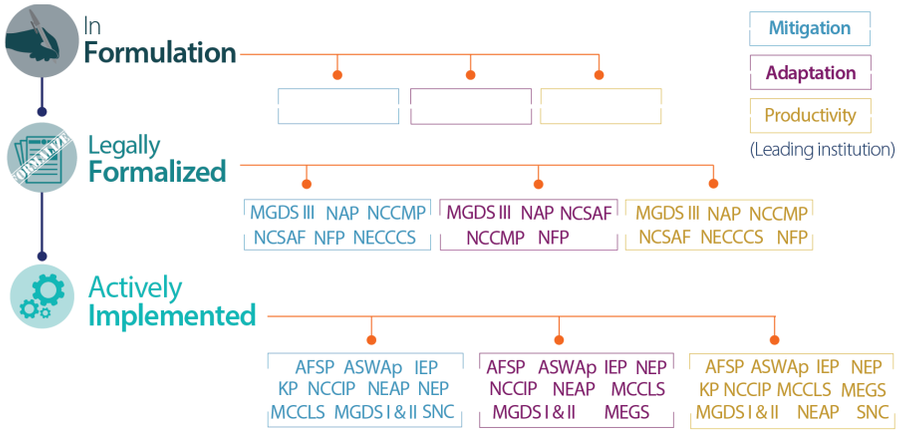
- The NCCMP touches on capacity building in relation to climate change awareness and impacts, and complements other policies relating to energy, water, agriculture and forestry.

- Outcome areas include reducing vulnerability to climate change impacts, reducing greenhouse gas emissions, increasing awareness about climate change, and enhancing capacity to implement climate change related interventions.

National Climate Smart Agriculture Framework (NCSAF) 2018

The NCSAF was developed through the auspices of the VUNA program (supported by DFID), whose objective was, inter alia to address the coordination problem in the CSA space. The NCSAF highlights the challenges that the agriculture sector faces and the action areas necessary to increase resilience, including creating an enabling

Enabling policy landscape for CSA in Malawi



AFSP Agriculture and Food Security Policy (2006) (Ministry of Agriculture, Irrigation and Water Development) **ASWaP** Agriculture Sector Wide Approach (2010) (Ministry of Agriculture, Irrigation and Water Development) **IEP** Integrated Energy Policy (2003) (Ministry of Natural Resources, Energy and Mining) **KP** Kyoto protocol (2002) (Ministry of Natural Resources, Energy and Mining) **MCCLS** Malawi's Climate Change Learning Strategy (2012) (Ministry of Natural Resources, Energy and Mining) **MEGS** Malawi Economic Growth Strategy (2004) (Ministry of Finance, Economic Planning and Development) **MGDS I & II** Malawi Growth and Development Strategy I and II (2011) (Ministry of Finance, Economic Planning and Development) **MGDS III** Malawi Growth and Development Strategy III (2017) (Ministry of Finance, Economic Planning and Development) **NAP** National Agriculture Policy (2016) (Ministry of Agriculture, Irrigation and Water Development) **NCCIP** National Climate Change Investment Plan (2004) (Ministry of Natural Resources, Energy and Mining) **NCCMP** National Climate Change Management Policy (2016) (Ministry of Natural Resources, Energy and Mining Environment Affairs Department) **NCSAF** National Climate Smart Agriculture Framework (2018) (Ministry of Agriculture, Irrigation and Water Development) **NEAP** National Environmental Action Plan (1994) (Environmental Affairs Department) **NECCS** National Environment and Climate Change Communication Strategy (2012-2014) (Ministry of Natural Resources, Energy and Mining) **NEP** National Environmental Policy (2004) (Ministry of Natural Resources, Energy and Mining) **NFP** National Forest Policy (2016) (Ministry of Natural Resources, Energy and Mining) **SNC** Second National Communication to the Conference of the Parties of the United Nations Framework Convention on Climate Change (2011) (Ministry of Natural Resources, Energy and Environment)

environment for enhancing adaptive capacity and resilience, climate risk management, and gender inclusiveness. The framework uses a value chain approach with the purpose of fostering commercialization, and emphasizes the need for capacity building, extension, and awareness-creation regarding the challenges posed by climate change.

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

Financing CSA

Malawi was the first African country to launch a National Climate Change Investment Plan that highlighted a number of funding options for climate change. Through different frameworks, the country has also benefitted from a number of donor-funded projects that seek to enhance resilience to climate change. For instance, in the financial years 2008/2009, 2009/2010, 2010/2011, the Africa Development Bank (AfDB), DFID, and the World Bank offered general budget support to Malawi and financed a number of programs (42). Despite such support, , as well as major donations from the United States Agency for International Development (USAID)[30], Malawi is yet to receive sufficient funding for climate change interventions to meet its needs (33).

Some of the dedicated climate change funds that Malawi has accessed to date include the Global Environment Facility (GEF), the Adaptation Fund (AF) and the Climate Investment Fund (CIF). Malawi also received about 9 million Euros from Irish Aid in 2016 to finance a range of climate change and resilience projects. The International Development Association (IDA) of the World Bank together with the GEF, and the Least Developed Countries Fund (LDCF) financed (up to US$ 136 million) the Shire River Basin Management project, which focused on catchment management and water-related infrastructure. Malawi has also received over 100 million euros from the European Union to support the KULIMA project[31]. The project seeks to increase agricultural productivity and diversification through CSA, enhance agriculture value chain and business development, support improved governance in the agriculture sector, and capacity building for agricultural extension.

Malawi has also received a number of funds from different UN agencies. The FAO has funded various projects, including the Economics and Policy Innovations for Climate Smart Agriculture (EPIC) programme of 2012, a project that aimed at identification, implementation of CSA practices and promoting policy reviews, and investments for CSA. The United Nations Environment Programme (UNEP) contributed to awareness creation on funding opportunities relating to Clean Development Mechanism (CDM), while the United Nations Development Programme (UNDP), together with DFID and the Government of Norway, funded the National Programme for Managing Climate Change (US$ 4,152,399), and the African Adaptation Programme (US$ 3,881,575) in collaboration with the Japanese government. The United Kingdom, through DFI, also funded the Enhancing Community Resilience Programme (ECRP), a project that started in 2011 and ended in 2017. The main goals of the project were to enhance the capacity to address impacts of climate change, disaster risk management, and adaptation of livelihoods to climate change. Some of the successes of the programme include more than doubling food security, doubling of incomes and capital assets, and enhancement of ability to respond to climate change. These were mainly achieved through the Village Savings and Lending Association (VSLAs)[32].

A number of funds have been devoted to agriculture and rural development program, which includes strengthening climate services in Malawi. The Green Climate Fund (GCF) funded the Scaling up of Modernised Climate Information and Early Warning Systems (US$ 12.3 million) that aims at developing and disseminating (through mobile phones, print media and radio channels) agricultural advisory services. The 'Strengthening Climate Information and Early Warning Systems in Malawi to Support Climate Resilience Development and Adaptation to Climate Change' funded by the GEF and UNDP (US$ 4 million) also sought to enhance access and utilization of early warning climate information[33].

However, access to climate financing in Malawi is still low. This is largely due to lack of awareness of most of the climate funds; more than 60% of the climate change funds for which Malawi is eligible are largely unknown to stakeholders[34]. Weak capacity, particularly in government institutions, to develop competitive grant proposals, and the stringent requirements of donor agencies, are additional challenges. Weak institutional linkages and some inter-agency competition also contribute to the issue. For example, some irrigation scheme projects have stalled following disagreements between the Finance Ministry and the Department of Irrigation over who should manage the funds (43).

30 For instance, USAID has collaborated with other organizations such as Michigan State University and Catholic Relief Services (CRS) in the Strengthening Agriculture and Nutrition Extension Service (SANE) project that seeks to strengthen the capacity of the DAES in delivery of extension.

31 KULIMA is "Kutukula Ulimi m'Malawi" in Chichewa, which means "promoting agriculture" in Malawi.

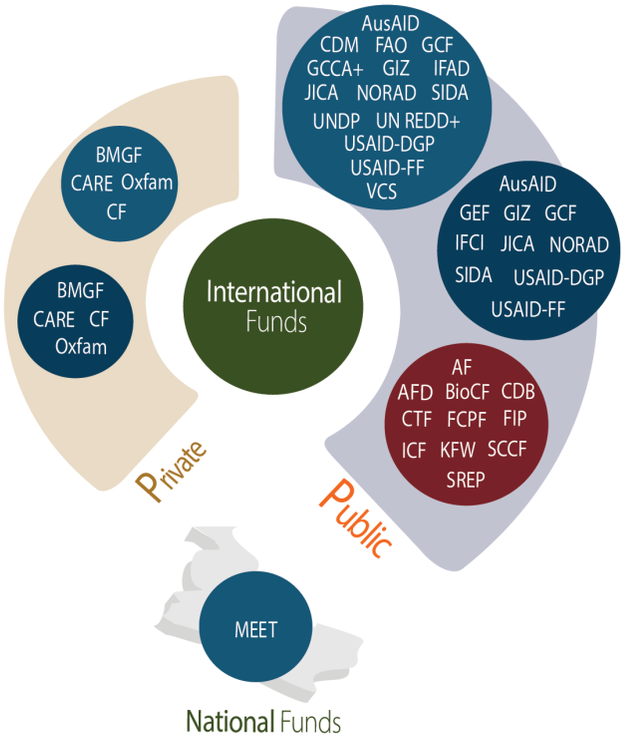
32 More information is available at: http://www.care.org/work/world-hunger/enhancing-community-resilience-malawi-provides-2900-return-investment

33 Details on the on-going projects relating to resilience is available in the GoM (2017).

34 This is based on workshop participants. A complete of the participants' list is available at the end of the document. The list of finances is available at: https://qdd.oecd.org/subject.aspx?subject=climatefundinventory

National funding levels for CSA are very low, despite commitments in the National Climate Change Investment Plan (NCCIP) to governmental contributions to climate change funds. To date, there is no national fund devoted to climate change in Malawi apart from the Malawi Environment Endowment Trust (MEET) that focuses on afforestation, soil and water conservation, environmental health, waste management, renewable energy, and climate change. There is a proposal to establish a National Irrigation Fund (NIF) that would increase investment in irrigation.

Financing opportunities for CSA in Malawi



- Funds actually accessed by country for CSA purposes
- Funds actually accessed by country for purposes other than CSA
- Funds not accessed by the country

AF Adaptation Fund **AFD** French Development Agency **AusAID** Australian Agency for International Development **BioCF** World Bank BioCarbon Fund **BMGF** Bill and Melinda Gates Foundation **CARE** Cooperative for Assistance and Relief Everywhere **CDM** The Netherlands Clean Development Mechanism **CDB** China Development Bank **CF** The Clinton Foundation **CTF** Clean Technology Fund **FAO** Food and Agriculture Organization of the United Nations **FCPF** Forest Carbon Partnership Facility **FIP** Forest Investment Program **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 **IFAD** International Fund for Agricultural Development **IFCI** Australia's International Forest Carbon Initiative **JICA** Japan International Cooperation Agency **KfW** German Development Bank International Climate Initiative **NORAD** Norwegian Agency for Development and Cooperation **MEET** Malawi Environment Endowement Trust **SCCF** Special Climate Change Fund **SIDA** Swedish International Development Cooperation Agency **SREP** Scaling Up Renewable Energy in Low Income Countries Program **UNDP** United Nations Development Programme **UN REDD** United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation **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.

Potential Climate Finance

Malawi has accessed substantial funding from the GEF, GCF, the EU and the World Bank. Indeed, the Pilot Program on Climate Resilience (PPCR) identifies these agencies as potential for funding itself and other climate change initiatives in the agriculture sector. A proposal has also been submitted to the Bill and Melinda Gates Foundation (BMGF). Though the above are major climate donors in the country, there remains significant opportunity to widen the scope of target funds for which Malawi is eligible that have not yet been accessed, e.g. the Least Developed Countries Fund (LDCF). The private sector, including insurance companies, processors and manufacturers, among other national stakeholders, also offer important opportunities for climate funding. Some private sector organizations, including Agora and Ex-Agris Africa, have dedicated funds to directly or indirectly achieving at least one of the objectives.

Outlook

Malawi has a relatively strong policy environment for climate change adaptation and resilience. However, as in many African countries, implementation of the policies and coordination of the relevant stakeholders remains a challenge. The lack of implementation is partly due to insufficient financial resources arising from low national budgetary allocation for climate resilience and adaptation measures. A lack of awareness and capacity to develop competitive proposals also limits access to international funds. The financial situation of Malawi has a direct effect on the institutional framework for climate change in the country. Indeed, the agenda for CSA is mostly driven by international NGOs rather than the national government. This negatively affects the continuity and sustainability of most CSA initiatives, and impairs the development of functional private and public partnerships at national level necessary for enhancing CSA.

A number of challenges also hinder adoption of CSA practices at the farm level. A lack of knowledge about such practices, lack of relevant inputs, and poor access to both input and output markets, especially on the part of smallholders, are ongoing challenges. Female farmers in particular have low access to and control over agricultural productive resources, technologies, and markets. The bias towards CA is also a significantly limiting factor to adoption of other important CSA adaptation strategies. Weak coordination of CSA activities and projects in the country impedes scaling out of CSA practices. This is despite the presence of a wide range of platforms and alliances in charge of different aspects of CSA, climate change, and resource management.

Nonetheless, there is major potential for enhancing resilience in the agriculture sector in Malawi. Most of the proposed CSA strategies in relevant policy documents are yet to be implemented. Yet number of CSA options are already being utilized. There is an important opportunity to expand the scope of climate-smart practices promoted by government

and other actors beyond CA to include indigenous and farmer knowledge, and CSA practices optimized for different regions of the country. There are plans underway for CSA capacity building in the national extension system via the KULIMA project and the Strengthening Agricultural and Nutrition Extension in Malawi (SANE) project. These projects also aim to strengthen the extension system for more efficient and timely diffusion of accurate and useful agricultural knowledge, products, and services to farmers.

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For further information and online versions of the annexes, visit: https://ccafs.cgiar.org/publications/csa-country-profiles

Annex 1: Selection of agricultural production systems key for food security in Malawi (methodology)
Annex 2: Assessing climate-smartness of ongoing practices (methodology)
Annex 3: Institutions for CSA in Malawi (methodology)
Annex 4: Policies for CSA in Malawi (methodology)
Annex 5: Assessing CSA finances in Malawi (methodology)
Annex 6: Malawi's agro-ecological zones

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