

Monitoring and Evaluating Development Projects Using GIS

A Case Study of the Australia Africa Community Engagement Scheme (AACES): Shared Futures Project

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List of Acronyms

AACES – Australia Africa Community Engagement Scheme

AFAP – Australian Foundation for the People of Asia and the Pacific

Aus Aid – Australian Aid

CTDT – Community Technology Development Trust

GIS – Geographical Information System

GPS – Global Positioning System

MCH – Maternal Child Health

M&E – Monitoring and Evaluation

SPHERE – Minimum standards in humanitarian response

SFP – Shared Futures Project

WASH – Water, Sanitation and Hygiene

Executive Summary

The purpose of this handbook is to provide a source of information for operating a **Monitoring and Evaluation (M&E) System** which integrates **Geographic Information System (GIS)** outputs to display program and project outcomes. **Monitoring** is the process of data collection and measurement of progress toward program objectives. **Evaluation** is the periodic assessment of changes in desired outcomes that can be attributable to a program's interventions. M&E is important tool targeting two key elements to any development project – effectiveness and sustainability. However it is important to note that M&E of the impact of development work has not been efficient and effective due to work implementation plans which do not incorporate rapid and easy to visualise graphic illustrations such as GIS cartographic maps, charts and graphs. Integrating M&E and GIS is against the premise that, “*what gets measured gets improved* (Dr Peter Drucker). Added to that, 80% of global data has a location component. One cannot see what any data is trying to tell with charts and graphs alone. GIS mapping (also known as location analytics) provides you with a highly visual means to extract this missing analytic and ensure that you have the clearest possible view of your data. Location Analytics augments project implementation systems with mapping visualization that complements existing functionality. There is enhanced insight into project data, without disruption to usual information workflow. Location Analytics delivers the missing perspective to usual project information flow. The Australia Africa Community Engagement Scheme (AACES) Shared Futures Programme was implemented in Wards 4, 14, 15, 16 & 17 of Mutoko District, Mashonaland East Province, Zimbabwe. An M & E system had been developed with a spatial component whereby every location's global positioning system (GPS) coordinates of activity implementation was recorded. This handbook is aimed at illustrating GIS as a tool for improving evidence & location-based M & E of rural development

interventions over the period 2011 to 2015. Handbook show cases visual presentation of Baseline Survey data, and location-based monitoring of key Indicators over time. Informative and illustrative maps for years 2011, 2013 and 2015 are used to show progression of project implementation and intervention monitoring over the stated years.

Introduction

The Australia Africa Community Engagement Scheme (AACES) Shared Futures Project intends **to achieve measurable improvements** to the **sustainable livelihoods** and **well-being of vulnerable households** in Mutoko District, Mashonaland East Province, Zimbabwe. The project is funded by the Department of Foreign Affairs and Trade (DFAT) through the Australian Foundation for the People of Asia and the Pacific (AFAP). Project implementation has been led by Community Technology Development Trust (CTDT) and has run over 4 years (2011 to 2015). Of great importance was the situation Baseline Survey undertaken in 2011 to ascertain level of household access to adequate Water, Sanitation & Hygiene (WASH) facilities, mothers' access to Maternal Child Health (MCH) facilities and annual household food security & nutrition. A results-based project management system was put in place. One key element in the approach was formulating a monitoring and evaluation (M&E) system.

M&E is a powerful management tool that can be used to improve the way governments and organizations achieve results. M&E is a good performance feedback system. M&E has evolved from traditional implementation-based approaches, towards new results-based approaches. The introduction of a results-based M&E system takes decision makers one step further in assessing if and how goals are being achieved over time. These systems help to answer the all-important “**so what**” questions and respond to stakeholder’s growing demands for results.

Monitoring is the process of data collection and measurement of progress toward program objectives. **Evaluation** is the periodic assessment of changes in desired outcomes that can be attributable to a program's interventions. M&E is an important tool targeting two key elements to any development project – effectiveness and sustainability.

However it is important to note that M&E of the impact of development work has not been efficient and effective due to work implementation plans which do not incorporate rapid and easy to visualise graphic illustrations such as **Geographical Information System (GIS)** cartographic maps, charts and graphs. This author's experience is that using maps to present M&E results is one of the most effect methods of communicating outcomes in a way that is easily understood by many people from various backgrounds. Eighty percent (80%) of global data has a location component. One cannot see what any data is trying to tell with charts and graphs alone. GIS mapping (also known as location analytics) provides you with a highly visual means to extract this missing analytic and ensure that you have the clearest possible view of your data. Location Analytics augments project implementation systems with mapping visualization that complements existing functionality. There is enhanced insight into project data, without disruption to usual information workflow. Location Analytics delivers the missing perspective to usual project information flow.

How can M&E and GIS work together? M&E and GIS have a fundamental difference: M&E is temporally focused – measuring changes and outcomes occurring over time and GIS is spatially oriented – identifying where the outcomes are occurring. Our challenge is to merge these two different views into one tool that will display useful information in support of a successful outcome for the project. How we accomplish this depends heavily on selecting appropriate, meaningful data for monitoring the project.

What is the history of M&E-GIS development? Maps have been used in monitoring and evaluation systems long before computers and technical names for processes were developed. One of the early adapters in 1854 was Dr John Snow who depicted a cholera outbreak in London using points plotted on a map to represent the locations of individual deaths from cholera. His study of the distribution of cholera deaths led Dr Snow to propose that the source of the disease was a contaminated water pump, the Broad Street Pump, whose handle he had removed in an effort to curtail the spread of the cholera outbreak. While the basic elements of topography and theme existed previously in cartography, the John Snow map was unique, using cartographic methods not only to depict but also to analyze clusters of geographically-dependent phenomena. Dr. Snow's use of a map to display the data he had collected is similar to the method used and documented in this handbook.

The purpose of this handbook is to address some ways to use GIS maps for effective communication in support of the M&E process. In the narrow sense, a GIS is a technology tool that links databases and digital maps. GIS adds the dimension of geographic spatial analysis to information technology by providing an interface between the data and a map. This makes it easy to present information to key decision-makers quickly, efficiently and effectively. All data is therefore attached to a location thereby easily answering the **4W – What, Where, When and by Who.**

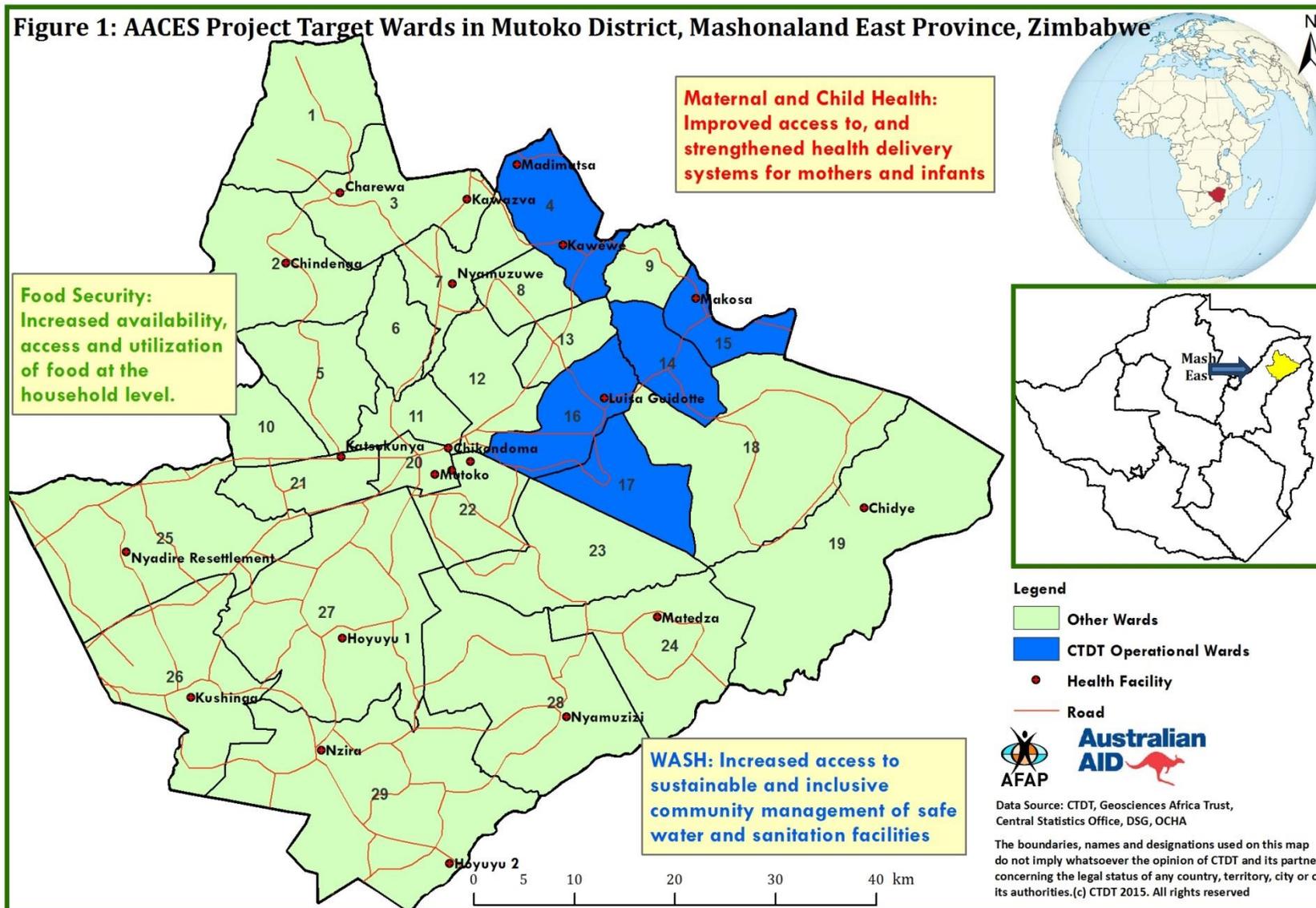
The overall goal of the Australia Africa Community Engagement Scheme (AACES) Shared Futures Project is **to achieve measurable improvements to the sustainable livelihoods and well-being of vulnerable households** in Mutoko District, Mashonaland East Province, Zimbabwe.

Specific objectives by thematic area are:

1. **Maternal and Child Health:** Improved access to, and strengthened health delivery systems for mothers and infants;
2. **WASH:** Increased access to sustainable and inclusive community management of safe water and sanitation facilities; and
3. **Food Security:** Increased availability, access and utilization of food at the household level.

The Australia Africa Community Engagement Scheme (AACES) Shared Futures Project was implemented in Wards 4, 14, 15, 16 & 17 of Mutoko District, Mashonaland East Province, Zimbabwe. An M & E system had been developed with a spatial component whereby every location's global positioning system (GPS) coordinates of activity implementation was recorded. This handbook is aimed at illustrating GIS as a tool for improving evidence & location-based M & E of rural development interventions over the period 2011 to 2015. Handbook show cases visual presentation of Baseline Survey data, and location-based monitoring of key Indicators over time. Informative and illustrative maps for years 2011, 2013 and 2015 are used to show progression of project implementation and intervention monitoring over the stated years. **Figure 1: Mutoko District map** shows the location of Wards where project implementation took place.

Figure 1: AACES Project Target Wards in Mutoko District, Mashonaland East Province, Zimbabwe



Chapter 1: Maternal and Child Health

The AACES Shared Futures Project implementation is within a specific geographical location. This handbook traces 5 key measurable indicators to monitor outcomes over the period 2011 to 2015. The key indicators are;

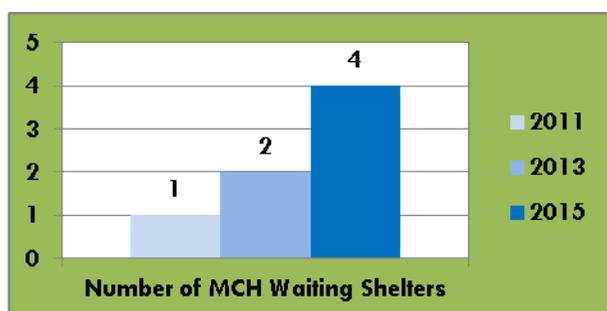
1. Number and location of maternal waiting homes in Wards 4, 14, 15, 16 & 17 of Mutoko District.
2. Percentage mother giving birth at a Public Health Facilities (Clinics) in Wards 4, 14, 15, 16 & 17 of Mutoko District.
3. Percentage pregnant mother with access to a waiting home.
4. Percentage malnourished babies below the age of 5.
5. Percentage children who are vaccinated before reaching 12 months of age.

At baseline (September 2011), Public Health Facilities (Clinics) in Wards 4, 14, 15, 16 & 17 of Mutoko District had one (1) Maternal Waiting Home. The Maternal Waiting Home is situated in Ward 16 at Louisa Guidotte (All Souls) Mission Hospital. Given the foregoing, only 15.4% of pregnant mothers delivered babies at the Public Health Facility (Clinic), whilst 84.6% delivered at home (under unhygienic circumstances), had a miscarriage or delivered on their way to a clinic. This scenario may have resulted in the 47% malnourished children below 5 years of age, though malnutrition is also attributed to the low levels of household food security (40%) and low household dietary score (2) in 2011. MCH level indicators are graphically and spatially illustrated in **Figure 2 AACES - SF Project in Mutoko: Maternal Child Health (MCH) State September 2011**.

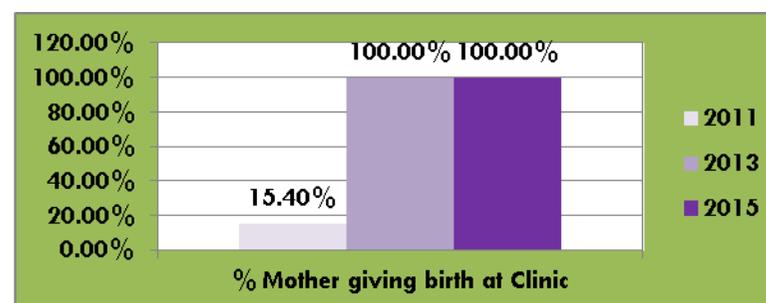
By September 2013 (2 years later), the scenario had changed. One (1) new maternal waiting home had been constructed at Kawere Clinic in Ward 4 by CTDT with funding from DFAT. As a result by September 2013, 64.3% of pregnant mothers had access to adequate waiting home, compared to 24% at baseline in 2011. 100% of mothers gave birth at public health

facility (clinic) compared to 15.4% at baseline. Kawere Clinic started recording a monthly average of 18 baby deliveries compared to zero (0) at baseline. By September 2013, 100% mothers take children for vaccination compared to 97% at baseline. Only 7.1% children under 5-years of age show malnutrition signs compared to 47% at baseline. MCH level indicators are graphically and spatially illustrated in **Figure 3 AACES - SFProject in Mutoko: Maternal Child Health (MCH) State at 1 September 2013**.

By September 2015, CTDT and AFAP through funding from DFAT had constructed 2 more maternal waiting homes. The homes are at Makosa (Ward 15) and Kapondoro (Ward 14) Clinics respectively. Therefore project implementation saw a 300% increase in the number of maternal waiting homes. It is important to note that the waiting homes are spatially and evenly distributed to cater for all pregnant mothers across the 5 target Wards. **Figure 4 AACES – SF Project in Mutoko: Maternal Child Health (MCH) State at 1 September 2015**. Increase in number of Maternal waiting homes is also in Graph 1. An example of Maternal Waiting Home facilities built by CTDT and AFAP with funding from DFAT are shown in **Photos: Makosa MWH and Kapondoro MWH constructed by CTDT by 2015**).



Graph 1: Number of MCH Waiting Homes



Graph 2: % mother giving birth at Clinic (Public health Facility)

Figure 2: AACES Project in Mtoko District: Maternal Child Health (MCH) Level at 1 September 2011

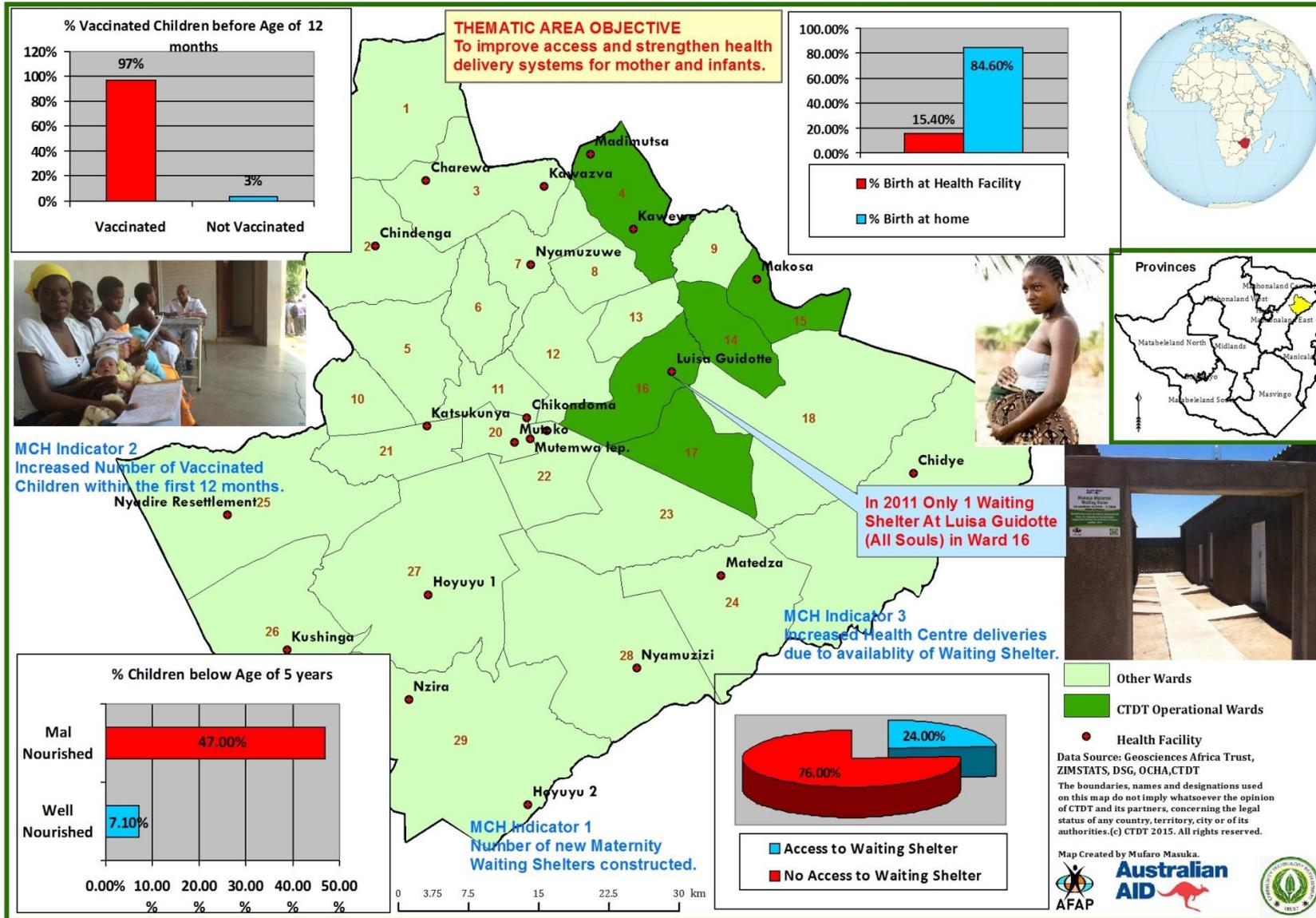


Figure 3: AACES Project in Mtoko District: Maternal Child Health (MCH) Interventions Map 1 September 2013

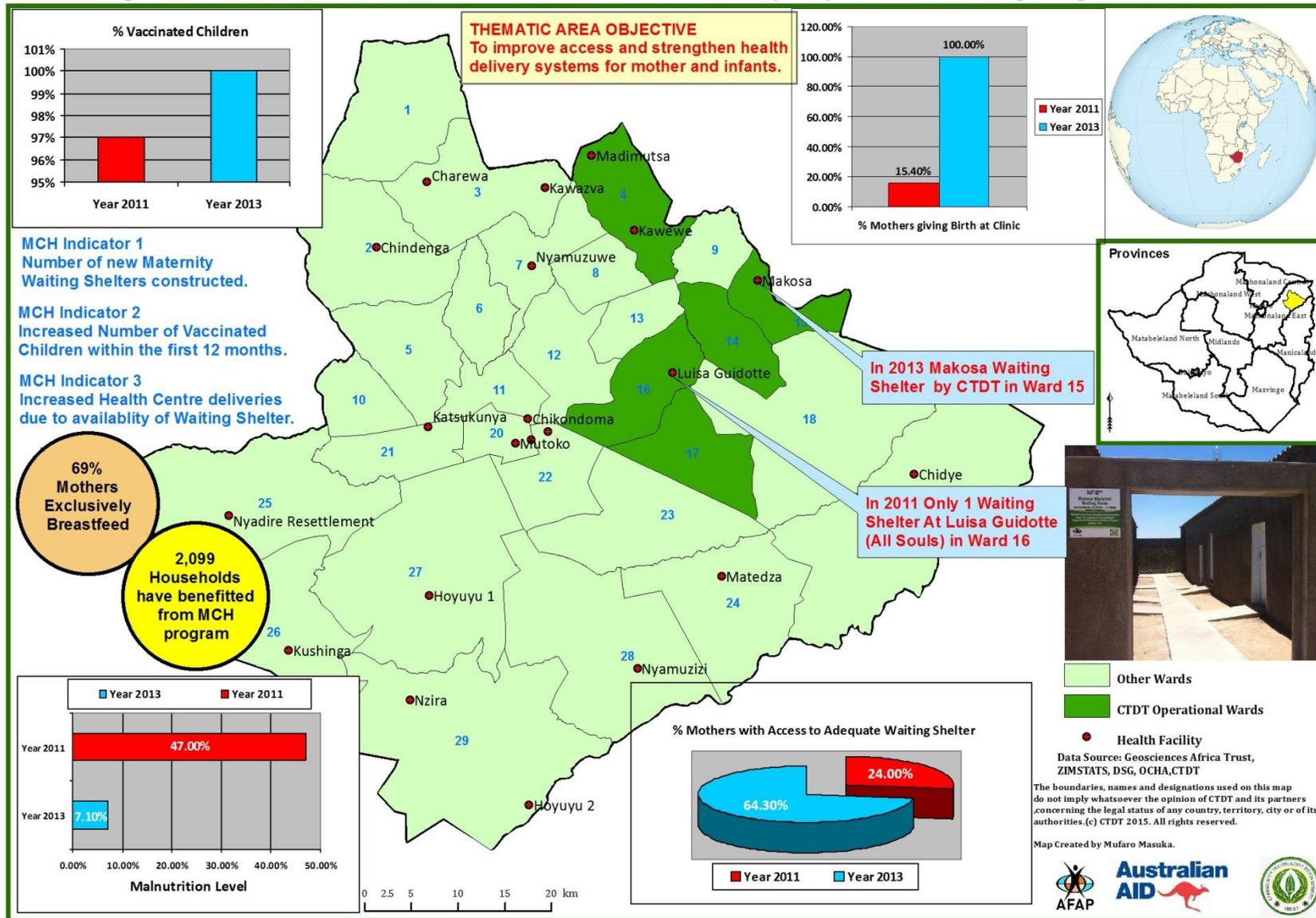
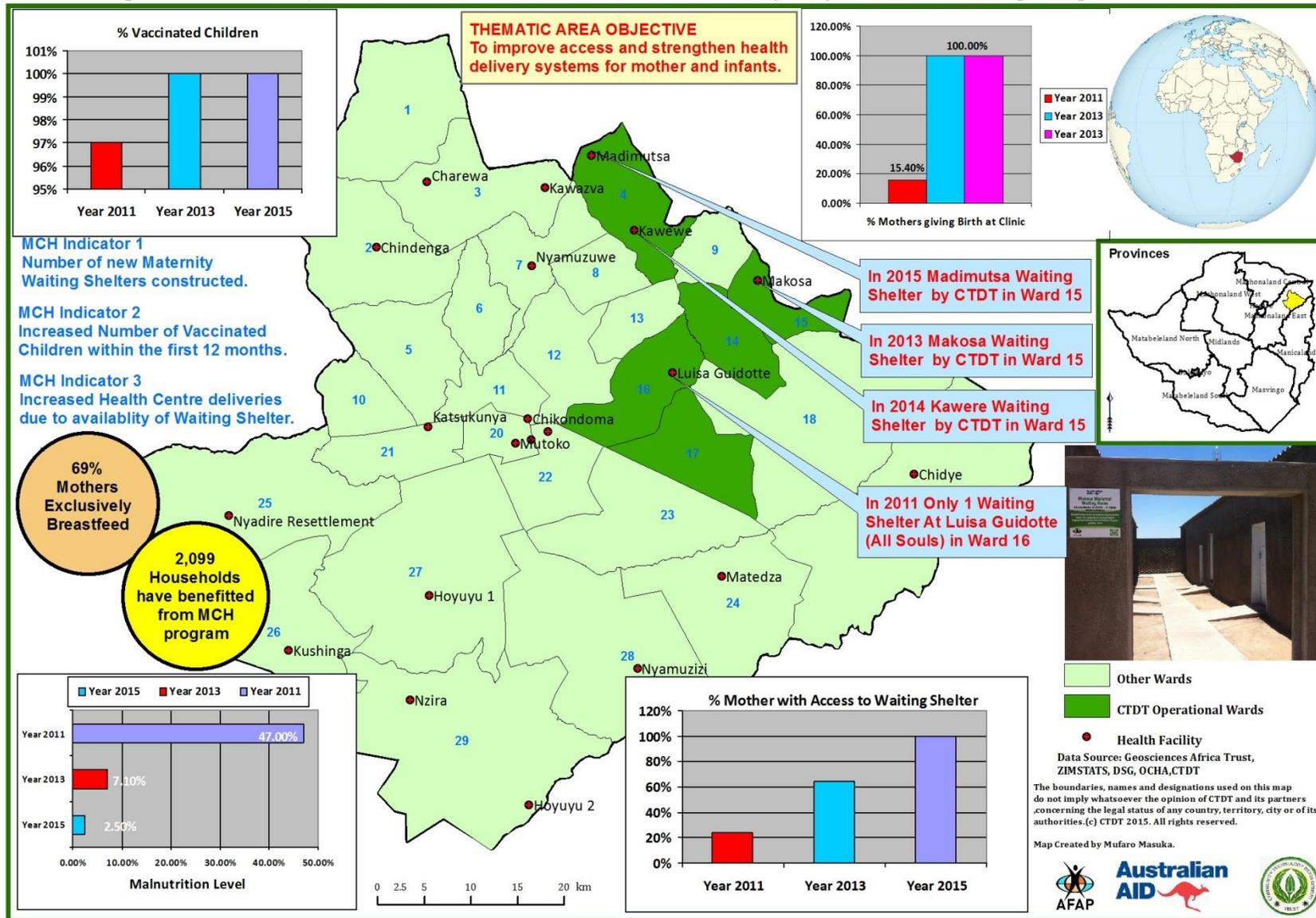


Figure 4: AACES Project in Mtoko District: Maternal Child Health (MCH) Interventions Map 1 September 2015



Photos: Kawere MWH and Kapondoro MWH constructed by CTDI by 2012 and 2015 respectively

Chapter 2: WASH

Five (5) key WASH measurable indicators to monitor project outcomes, by location over the period 2011 to 2015 were traced. The key indicators are;

1. Number and location of functional CTDI rehabilitated borehole in Wards 4, 14, 15, 16 & 17 of Mutoko District.
2. Number of households with access to sustainable, portable, safe and clean water in Wards 4, 14, 15, 16 & 17 of Mutoko District.
3. Number of people with access to sustainable, portable, safe and clean water reaching national standards/levels in Wards 4, 14, 15, 16 & 17 of Mutoko District.
4. Percentage functional Village Water Committees for maintenance and monitoring of safe water sources.

5. Ratio of school pupils per squatting hole in the sanitary facilities at schools.

The bush pump borehole is proven a source of sustainable, portable, safe and clean water in rural and urban Africa. At baseline (September 2011), location and state of boreholes (whether functional or non-functional) in Wards 4, 14, 15, 16 & 17 of Mutoko District was mapped. This is illustrated in **Figure 5: AACES - SF Project in Mutoko District: Portable Water Access Level at 1 September 2011**. At baseline in 2011, 58% of the boreholes were functional, while the remaining 42% were non-functional across the project implementation area. Of major significance is Ward 4 which is the only administrative area which had less than 50% (47%) of functional boreholes at baseline in 2011. 46% of households used sustainable, portable, safe and clean water from the boreholes, while 60% used mainly unsafe water which is within 1km walking distance from their homes. Added to this, only 39% of villages had functional Village Water Committees. These committees oversee and monitor the maintenance of safe water sources.

In year 2011, 90% of the households in the target Wards did not have to appropriate sanitation facilities. Amongst these, 25% used pit latrines, 10% used blair toilets and 65% practiced open defecation. On the sanitation front, at baseline the school sanitary ratio was 1 squatting hole per 35 pupils. This was way out of the global SPHERE (minimum standards in humanitarian response) guidelines for pupils. Project sought to improve sanitary access to school pupils across the project implementation thereby targeting 10 schools, namely Chipfiko, Kaunye, Kawere, Madimutsa, Makosa, Masango, Rukau (Primary Schools) and Chatiza, Mushimbo, Rukau (Secondary schools) spread across the project area. Spatial distribution of schools is shown in **Figure 6: AACES - SF Project in Mutoko District: Portable Water Access Level at 1 September 2013**.

By September 2013, CTDI had rehabilitated a total of 45 non-functional boreholes spread across Ward 14, 15, 16 and 17. This increased access to sustainable, portable, safe and clean water. Resultantly 98.2% of household now used water from safe reliable clean sources compared to 46% at baseline. CTDI interventions also resulted in 87.3% having functional water committees at village level (compared to 39% at baseline). Improved access to sanitation facilities in schools reduced ratio to 1 squatting hole per 17 pupils after CTDI built an additional 10 holes of the Ventilated Improved Pit latrine (VIP) per target school. An example of school sanitary facilities built by CTDI with funding from DFAT through AFAP is shown in **Photo: Makosa Primary School, VIP latrines for pupil improved sanitation constructed by CTDI in 2012**). The sanitary intervention also resulted in 69% community members having access to improved VIP toilet facilities, compared to 35% at baseline. Figure 6 illustrates major indicator changes that took place between September 2011 and 2013.

Figure 5: AACES Project in Mtoko District: Portable Water Access Level at 1st September 2011

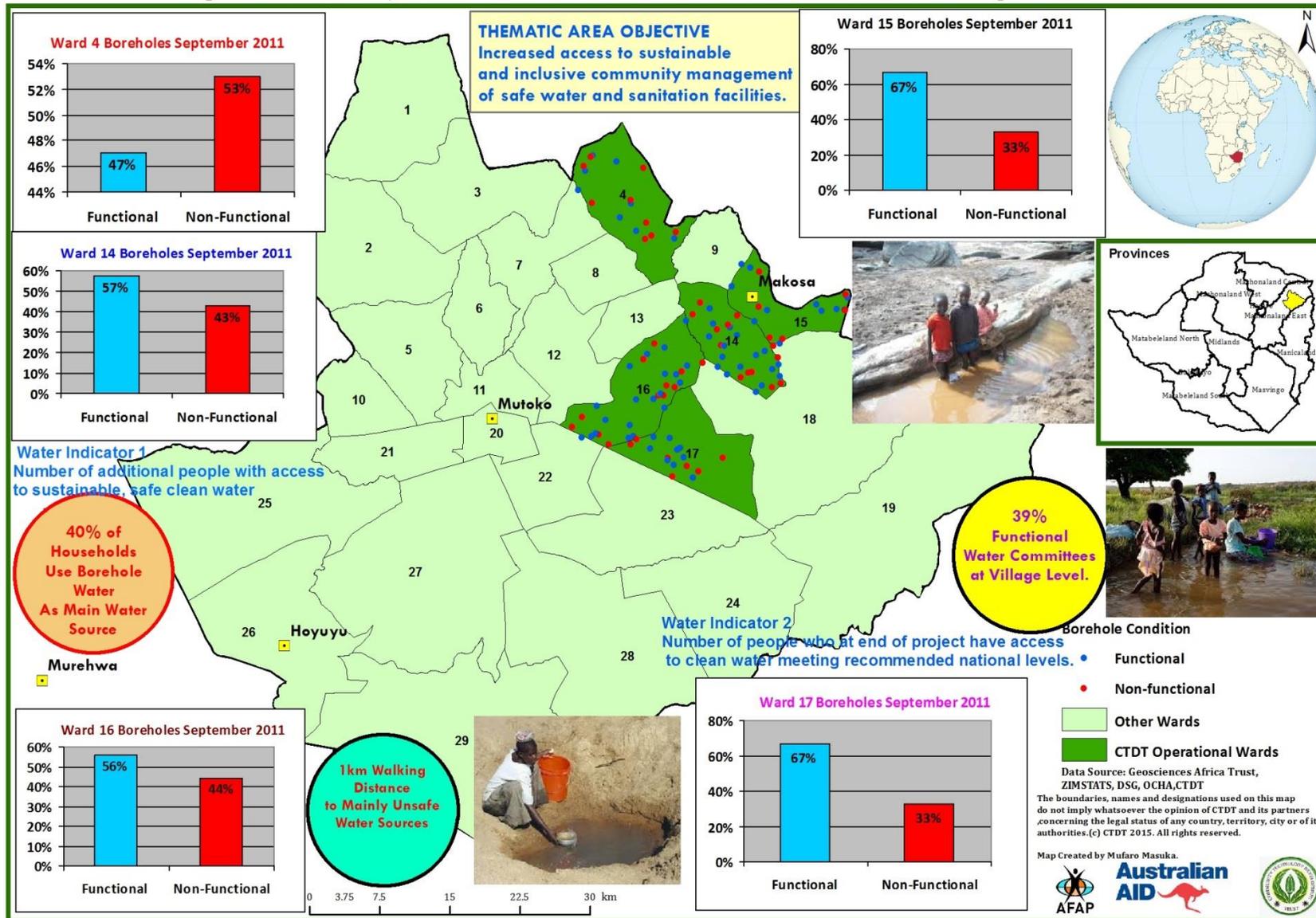


Photo 2.1: Kaunye Business Water point, rehabilitated by CTD in 2013.

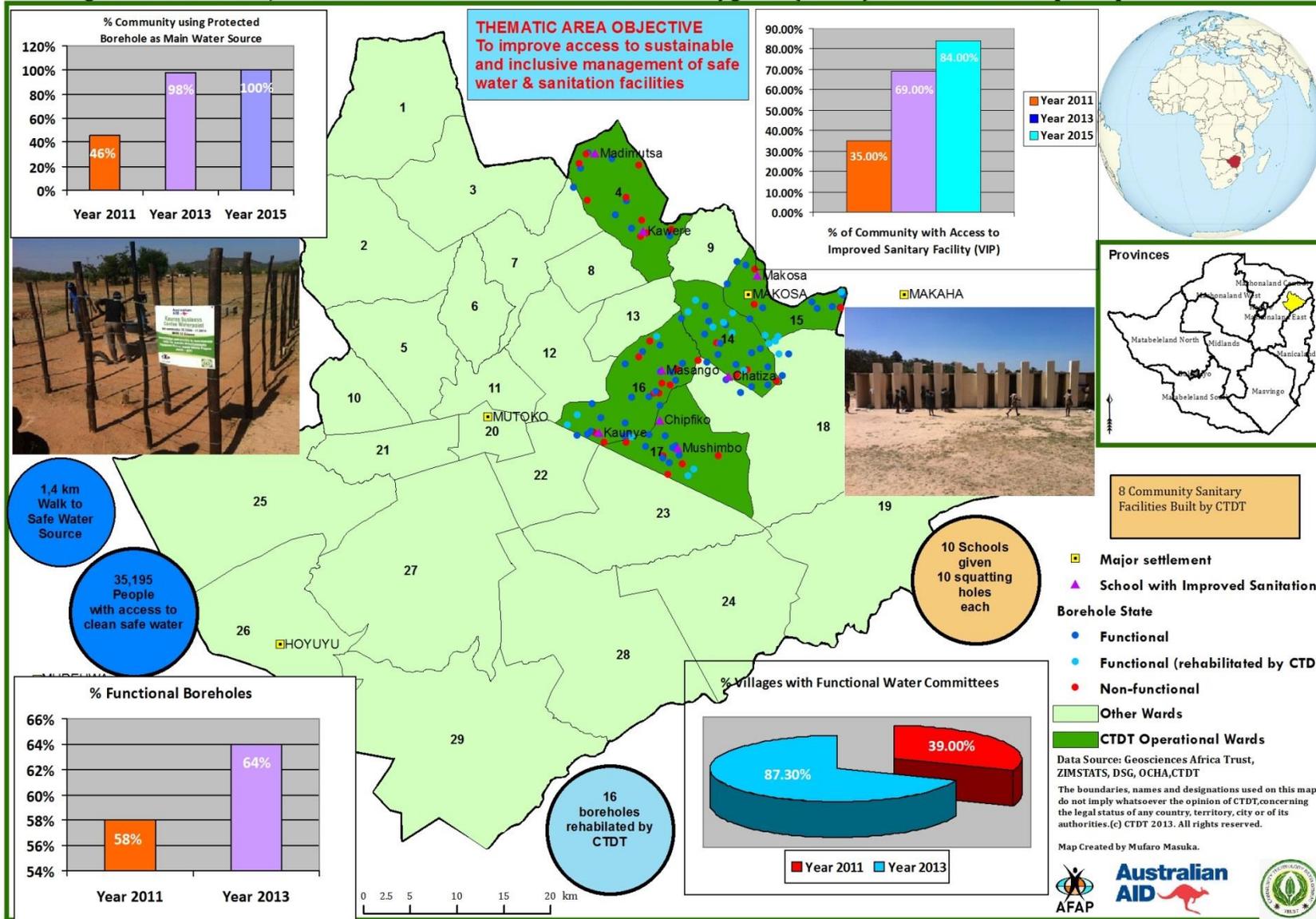
Photo 2.2 Kawere Water point Solar Panels to pump water by 2013

Photo: Makosa and Kawere Primary Schools, VIP latrines for pupil improved

By September 2015, a total of 26 689 people in project are accessing better sanitation facilities. They are getting portable above the SPHERE guidelines which recommend a maximum of water committees to lead the maintenance of safe, clean, sustainable access to adequate sanitation after 10 sanitary facilities were disability inclusive facility.



Figure 7: AACES Project in Mtoko District: Water, Sanitation & Hygiene (WASH) Interventions Map 1 September 2015



Chapter 3: Food Security & Nutrition

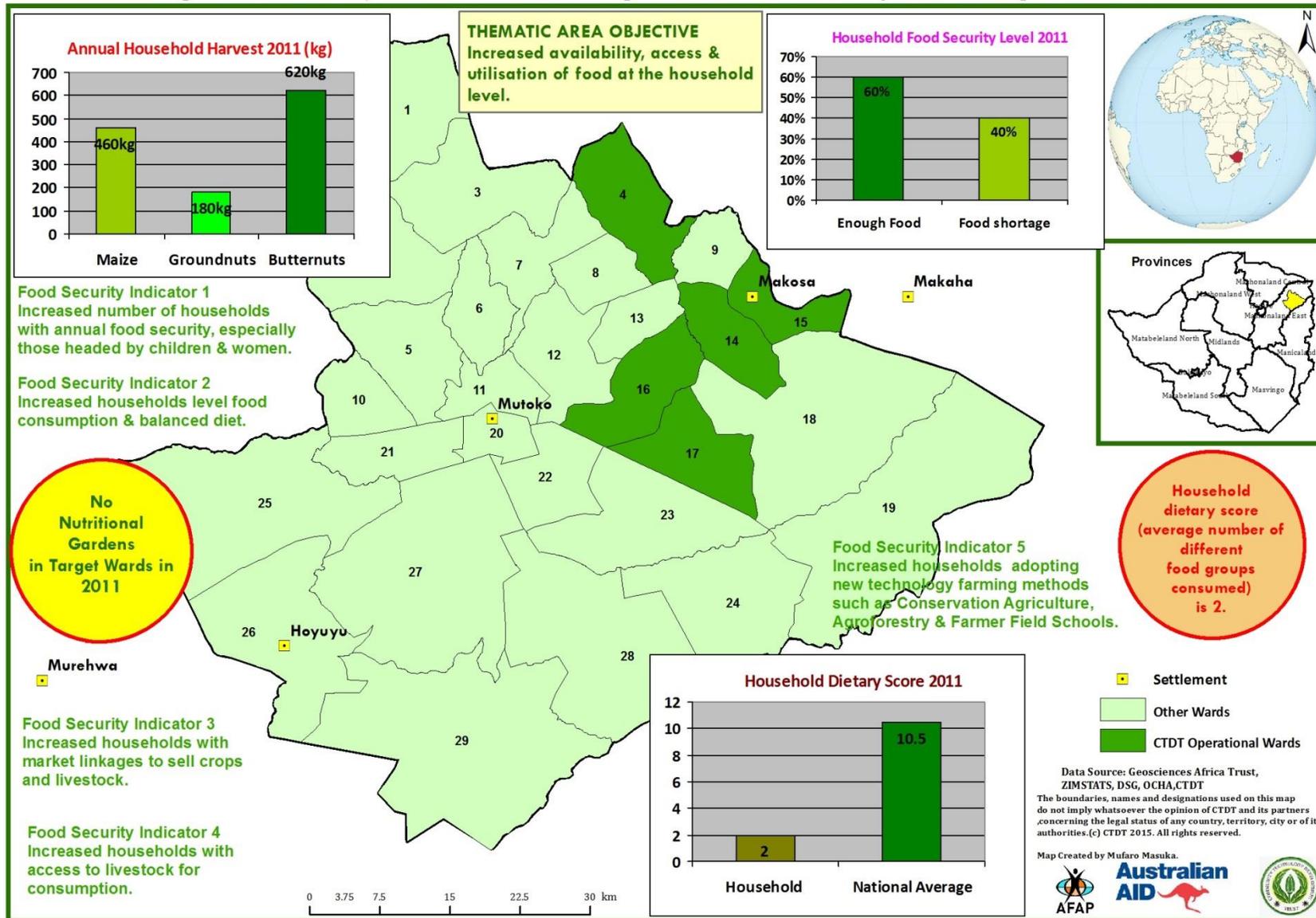
Household food security and nutrition is vital to the well-being of communities in Africa. CTDI interventions in Mutoko district aimed to increase food availability, access and utilisation at household level. Location based measurable indicators toward the outcome in this regard are;

1. Increased number of households with enough annual food security especially those headed by women and children.
2. Increased household level of food consumption and balanced diet (dietary diversity score).
3. Increased households with market linkages to sell crops and livestock.
4. Increased household with access to livestock consumption as food.
5. Increased household adopting new technology farming methods such as Agroforestry and Conservation Agriculture.

In year 2011, 60% of household in CTDI targets Wards 4, 14, 15, 16 and 17 of Mutoko district did not have enough annual food security. Average annual household harvest quantities by crop were 180kg for groundnuts, 460kg for maize and 620kg for butternuts. Household dietary score (variety in the food stuffs eaten in a household) was as low as 2. This means that people within a household ate at most only 2 different types of food stuffs. As a result malnutrition for children aged 5 years and below, stood at 47%. Figure 8 illustrates the food security and nutrition level in project area in 2011.

During the same year, it is important to note that the villages in the project area did not have any Nutrition Gardens, Farmer Field Schools and livestock rearing initiatives. Therefore dietary score, use of livestock for food consumption and uptake of new technology farming methods such as Agroforestry and Conservation Agriculture was low.

Figure 8: AACES Project in Mutoko District: Agriculture & Food Security Level at 1 September 2011



By September 2013, CTDI intervention had resulted in setting up of 6 Nutritional Gardens and 10 Farmer Field Schools across the target Wards. Location and spatial distribution of the food security sites is shown in **Figure 9: AACES - SF Project in Mutoko District: Agriculture & Food Security level at 1 September 2013**. As a result of the interventions, households with enough annual food security had risen from 60% in 2011 to 72.7%. The dietary diversity (score) rose to 5.3. Annual harvests for Maize, Groundnuts and Butternuts rose sharply. September 2013 facts and figures are given in comparison to 2011 and related to locations to show impact of project interventions. This is also illustrated in **Figure 9: AACES - SF Project in Mutoko District: Agriculture & Food Security level at 1 September 2013**.

By September 2015, the 8 Nutritional Gardens had benefitted 327 households. A further 742 households had benefitted from Farmer Field Schools. 16 households had gotten a start-up livestock for piggery set up. Also 30 households had embarked on poultry rearing. All these beneficiary households are spatially distributed across the project target area, in close proximity to the Nutritional Gardens and Farmer Field Schools. Maize, Groundnuts and Butternut production rose significantly between 2013 and 2015. Therefore the number of households with enough annual food security increased from 73% to 84% between the same dates. 161 households produce livestock (pigs & poultry) for consumption with 217 households having market access to sell both surplus crops and livestock. These and other achieved indicators are graphically illustrated in **Figure 10: AACES - SF Project in Mutoko District: Agriculture & Food Security level at 1 September 2015**.

Figure 9: AACES Project in Mutoko District: Agriculture & Food Security Level at 1 September 2013

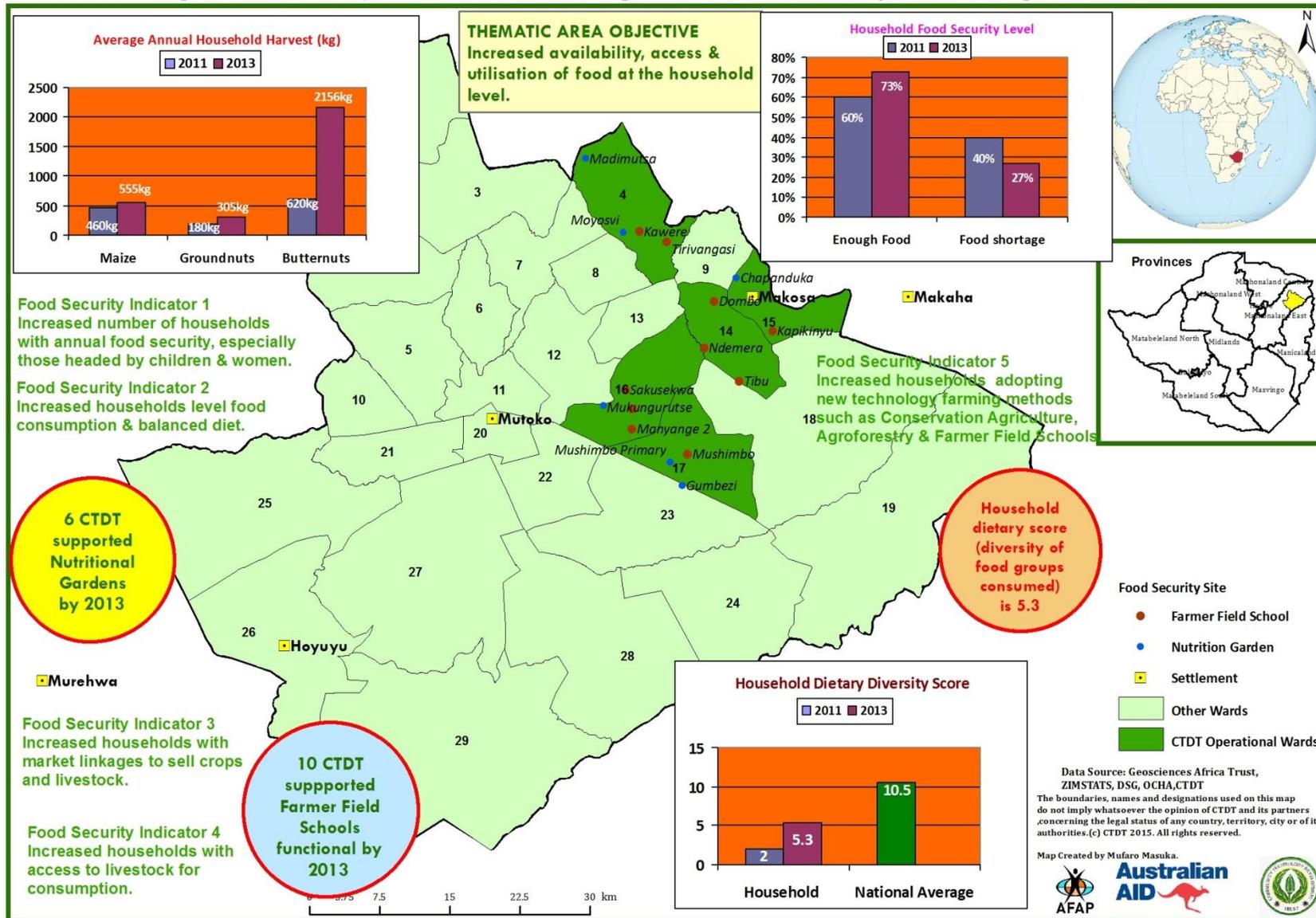


Figure 10: AACES Project in Mutoko District: Agriculture & Food Security Level at 1 September 2015

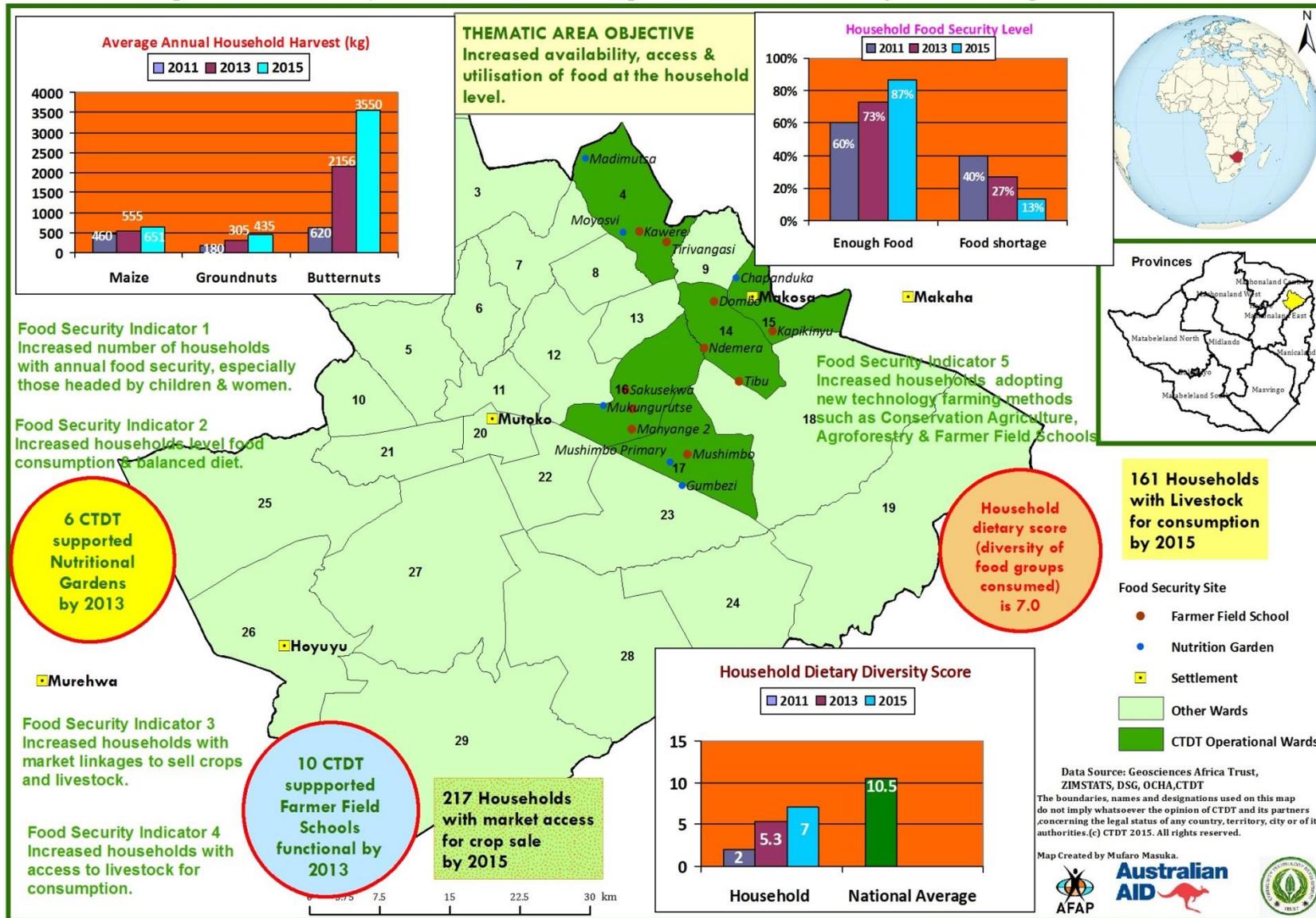


Photo: Post-harvest structure (granary) at Manyange farmer field school and Mwoyosvi Nutrition garden

Summary Conclusions

GIS and M&E can be successfully integrated to monitor, evaluate and document rural development project implementation and progress. Kusek and Rist, in *Ten Steps to a Results-based Monitoring and Evaluation System*, 2004 describe a step-by-step approach that has been used in a number of developing countries in the design and construct of M&E systems.

Step One: ***Conducting a Readiness Assessment***

Step Two: ***Agreeing on Outcomes to Monitor and Evaluate***

Step Three: ***Developing Key Indicators to Monitor Outcomes***

Step Four: ***Gathering Baseline Data on Indicators.***

Step Five: ***Planning for Improvements—Setting Realistic Targets***

Step Six: ***Monitoring for Results***

Step Seven: ***Evaluative Information to Support Decision-making***

Step Eight: ***Analyzing and Reporting Findings***

Step Nine: ***Using the Findings***

Step Ten: ***Sustaining the M&E System Within the Organization***

GIS - A missing but useful tool

Step Eight of this ten-step approach addresses “reporting findings” and suggests the use of “visual presentations—charts, graphs, and maps”. Examples of charts and graphs are included; and although **maps** are mentioned, no examples of using maps to report M&E findings are included.

CTDT’s experience through implementing the AACES-SFP project is that using maps to present M&E results is one of the most effective methods of communicating outcomes in a way that is easily understood by many people from various backgrounds. GIS maps are an effective communication in support of the M&E process.