LIVELIHOOD ZONES ANALYSIS
A tool for planning agricultural water management investments
Zambia

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About this report

The AgWater Solutions Project aimed at designing agricultural water management (AWM) strategies for smallholder farmers in sub Saharan Africa and in India. The project was managed by the International Water Management Institute (IWMI) and operated jointly with the Food and Agriculture Organization of the United Nations (FAO), International Food Policy Research Institute (IFPRI), the Stockholm Environmental Institute (SEI) and International Development Enterprise (IDE). It was implemented in Burkina Faso, Ethiopia, Ghana, Tanzania, Zambia and in the States of Madhya Pradesh and West Bengal in India.

Several studies have highlighted the potential of AWM for poverty alleviation. In practice, however, adoption rates of AWM solutions remain low, and where adoption has taken place locally, programmes aimed at disseminating these solutions often remain a challenge. The overall goal of the project was to stimulate and support successful pro-poor, gender-equitable AWM investments, policies and implementation strategies through concrete, evidence-based knowledge and decision-making tools.

The project has examined AWM interventions at the farm, community, watershed, and national levels. It has analyzed opportunities and constraints of a number of small-scale AWM interventions in several pilot research sites across the different project countries, and assessed their potential in different agro-climatic, socio-economic and political contexts.

This report was prepared as part of the efforts to assess the potential for AWM solutions at national level. The livelihood zones analysis divides the country in a series of areas where rural people share relatively homogeneous living conditions on the basis of a combination of biophysical and socio-economic determinants. It describes the main sources of livelihood of rural populations (by category of people), their natural resources base, potential and key constraints to development. It analyses the relation between people and water and helps understanding to what extent and how water can be a factor for development.
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## Abbreviations and acronyms

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<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AEZ</td>
<td>Agro-ecological zone</td>
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<tr>
<td>ARPT</td>
<td>Adaptive Research Planning Team</td>
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<td>AWM</td>
<td>Agricultural water management</td>
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<td>CSO</td>
<td>Central Statistics Office</td>
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<td>FAO</td>
<td>Food and Agricultural Organization of the United Nations</td>
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<td>FASAZ</td>
<td>Farming Systems Association of Zambia</td>
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<td>FEWSNET</td>
<td>Food Early Warning System Network</td>
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<td>FHSANIS</td>
<td>Food Security, Nutrition and Health Monitoring System</td>
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<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<tr>
<td>NTFP</td>
<td>Non-timber forest products</td>
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<td>NWP</td>
<td>North Western Province</td>
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<td>UNICEF</td>
<td>United Nations International Children’s Emergency Fund</td>
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<tr>
<td>WFP</td>
<td>World Food Programme</td>
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<td>ZVAC</td>
<td>Zambia Vulnerability Assessment Committee</td>
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</table>
1. **BACKGROUND**

1.1 **From farming systems to livelihood zones**

Farming Systems Research is based on a thorough understanding of the farming system practiced so that interventions can be tailored to unique circumstances and recommendations made. Over the years, weaknesses have been noted in the use of the farming systems approach. It became clear that farming systems focused on cropping enterprises and hardly addressed activities such as migrant labour or the work of metal workers beyond a mention in the diagnostic report. It was clear that what actually contributed to livelihoods was not addressed. The shift was thus made from a farming systems approach to a livelihoods approach.

The farming systems map of Zambia was created after nearly 10 years of diagnostic and on-farm research work. Since then, the Central Statistics Office (CSO) and the Zambia Vulnerability Assessment Committee (ZVAC) have produced a livelihoods map based on expert assessments and limited field verification. The Farming Systems Association of Zambia (FASAZ) and the Food and Agriculture Organization of the United Nations (FAO) have contributed to the refinement of the livelihood zones, in this case, by highlighting the irrigation layer.

1.2 **Targeting needs**

Work on improving livelihoods is guided by the definition of livelihoods by Chambers and Conway: A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. It comprises the adequate stocks and flows of food and cash required to meet basic needs. It is made up of a range of farm and off-farm activities, which together provide a variety of procurement sources for food and cash. Thus each household can have several possible sources of entitlement, which comprise its livelihood. These entitlements are based on endowments of a household, and its position in the legal, political and social fabric of society. A livelihood is sustainable when it (i) can cope with and recover from stress and shocks; (ii) maintain or enhance its capabilities and assets; and can (iii) provide sustainable livelihood opportunities for the next generation.

**Livelihood erosion** occurs when the options open to households on how to transform their endowments or assets into food and cash entitlements diminish. Examples of this might include natural resource degradation (decline in forests, groundwater, fish stocks); climatic shocks; changes trade levels and increase in illness. The risk of entitlement failure determines the level of vulnerability of a household to food insecurity. The greater the share of resources devoted to food acquisition the greater the vulnerability.

The following three attributes are embodied in the idea of a livelihood: possession of human capabilities (education, skills, health, self esteem, psychological orientation); access to tangible and intangible assets (stores, resources, claims and access), and the existence of economic, social/cultural, and consumption activities (e.g. gardening, fishing, farming).

It is understood that a farm household’s activities are influenced by the assets possessed by the household members, but often it is less readily recognized that both activities and asset levels may be heavily influenced by the capabilities of these members. The concept of capability is therefore one of the critical elements of the livelihood approach. Another important issue is the ability of the household to recover from stress and shocks, and hence the relative durability of these livelihoods. As such the concepts of resilience, social capital and sensitivity are important for livelihood analysis. The main point here is that people develop a range of livelihood activities, based upon their available assets and capabilities.
Livelihoods analysed

Livelihoods analysis is an approach that helps determine how people live or make a living. It incorporates an understanding of how household capabilities; assets and activities combine within a specified environment to achieve household well being in the short and long term. Livelihoods analysis assesses the resilience of household strategies in the face of shocks and stresses, and assists in identifying vulnerable areas or groups. The findings generated provide a useful framework for supporting households in resisting and recovering from both external threats, for example, drought, or internal threats, for example family illness. Equally, livelihoods analysis assesses the household strategies in the face of assets or endowments and capabilities, and assists in identifying high potential areas or groups.

A livelihoods analysis aims to increase understanding about:
- The nature of livelihoods for different categories of people.
- The main issues concerning livelihoods, such as:
  - major trends, problems and constraints;
  - shocks and stresses;
  - coping and adaptive strategies;
  - overall and absolute levels of livelihood insecurity and vulnerability.
- The opportunities and potentials for addressing these issues.
- Potential strategies and priorities as well as actions to be taken.

Many organizations and practitioners apply livelihood analytic approaches to gain insight into the lives and livelihoods of at risk communities. This information is used for planning, monitoring or evaluation. Moreover, an understanding of changing household and community livelihood strategies is critical when designing sustainable development policies as well as programmes that reduce risk and build on local capacities. Poverty-focused development activity should be dynamic: external support must recognize the dynamic nature of livelihood strategies, respond flexibly to changes in people’s situation, and develop long-term commitments.

External environment that influence livelihoods

The external environment will influence household capabilities, assets and activities. Examples of the external environment are the political climate including government policies, empowerment, basic services, community norms and values/claims, changes in the economy, markets, natural environment, donor programmes and politics.

2. Approach used to delineate the livelihood zones

This work is not the only attempt at dividing Zambia into livelihood zones. The first was by a CSO team charged to revise the Food Security, Nutrition and Health Monitoring System (FHANIS) methodology. A livelihood approach was deemed appropriate here in understanding the food and nutrition situation in a community and how it will change in the event of a stress. The FHANIS, was funded by the United Nations Children’s Fund (UNICEF) and a loan from the International Fund for Agricultural Development (IFAD) late 1990. The second attempt was the livelihood map developed under the auspices of the World Food Programme (WFP) and the Food Early Warning System Network (FEWSNet) and other partners. Again the objective was to gauge the food deficit to provide an early warning to the government and donors to facilitate appropriate response in times of stress. This present work aims to contribute to the understanding of livelihood zones by including a layer on the accessibility of water (surface and ground) and to low-cost water-lifting devices appropriate for smallholder irrigation.
Criteria for delineating zone boundaries were identified, including those that enriched the description of each livelihood zone (see Annex 3). Next, available national biophysical and socio-economic spatial data sets needed to describe the livelihood zones were collected and compiled from government agencies, academia and the United Nations. These were layered and used to describe the livelihood zones.

A single map was obtained where 18 livelihood zones were considered relatively homogeneous based on key variables such as agro-ecological regions, agricultural practices, crops grown, access to markets and availability of water. The presence of game reserve areas, land cover and topography were also taken into consideration.

During the participatory mapping exercise, groups were given general guidance but the choice of delineation factors were left open. Each group adopted a rather different mapping approach and came up with different maps based on different priority criteria that increased the richness of the exercise and gave a slight variation in emphasis. Discussions of characteristics, points of similarities and differences, enabled participants to successfully arrive at an agreement on a common list of livelihood zones and their mapped boundaries.
Figure 1 – Data sets used in livelihood delineation and description
3. **SYNOPTIC PRESENTATION OF AGRO-ECOLOGICAL REGIONS AND BROAD LIVELIHOOD SYSTEMS**

The agro-ecology of Zambia is roughly divided into three regions according to rainfall and soil characteristics (reference: Figure 1 above, top left). The following describes the general features of these three regions. Details of soil characters are explained in Annex 2.

3.1 **Region I**

This Region has less than 800 mm of annual rainfall and accounts for 12 percent of the total land area. The total area amounts to 17.3 million ha, the smallest among the three regions. The region includes the arid zone covering South Province, East Province, the Gwembe Valley of Central Province, and the semi-arid zone of West and South Provinces. The crop-planting season is short normally in the range of 80-120 days. Accordingly, it is suitable for growing drought-resistant crops such as millet, sorghum, sesame and cotton. Maize can be cultivated with irrigation even in the dry season. The region is also suitable for raising cattle, while the cultivation of cassava is limited. The valley area along the Zambezi river is low-lying; consequently the temperature and humidity are high. Because this area is the habitat of tsetse flies, cattle raising is not feasible.

3.2 **Region II**

The Region is located at the centre of the country, and includes Western Province, Central Province and Eastern Province and a part of Northern Province. Total area amounts to about 27.4 million ha, accounting for 42 percent of the total national area, ranking as second among the three regions. The soil appears to be very fertile. The annual rainfall is 800-1 000 mm and there is no freezing even during the low temperature season. The crop planting period is between 100-140 days.

Region II is further divided into II-a and II-b Sub-Regions. The II-a Sub-Region is located in the fertile plateau covering the four provinces of Central, Lusaka, Southern and Eastern, these provinces generally have fertile soil. In this region the following crops are cultivated under irrigation: maize, cotton, tobacco, sunflower, soybean, groundnut and wheat. The area is also suitable for flowers and paprika.

Sub-Region II-b is included in Western Province, where sandy soil predominates. The area is suitable for the production of cashew nut, rice, cassava, millet, vegetables, timbers and livestock production such as beef, dairy and poultry.

3.3 **Region III**

The Region is in one of the highest rainfall areas with the average annual rainfall of 1 000-1 500 mm. The crop production period suitable for crop is 120-150 days. The region accounts for 46 percent of the entire national area, and covers Northern Province, Luapula Province, Copperbelt Province, most of Northwest Province, and part of Central Province. Except for the Copperbelt Province, the soil in the Region is in an advanced stage of leaching and acidification, after application of lime it can be used as farmland. The soil is suitable for the production of millet, cassava, sorghum, beans and groundnut. Coffee, sugar cane, rice and pineapple are also planted. The stream water flows without interruption throughout the year and can be utilized for small-scale irrigation. Development of freshwater fish and aquaculture are also found.
<table>
<thead>
<tr>
<th>Livelihood zone</th>
<th>Description</th>
<th>Livelihood sources</th>
<th>Farmers typology</th>
<th>Rural population density</th>
<th>Gender</th>
<th>AEZ region</th>
<th>Criteria for AWM potential</th>
<th>Priority for intervention</th>
<th>Notes</th>
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<td></td>
<td></td>
<td>Traditional Emerging Commercial</td>
<td></td>
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<td>Poverty incidence Market access Potential for water dev Livelihood depending on water</td>
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<tr>
<td>1</td>
<td>Grassland area with (vulnerable) small scale farmers with cassava, sorghum, and cattle and timber</td>
<td>Cattle, Millet, Sorghum, Tourism, Timber</td>
<td>100</td>
<td>Low mhh</td>
<td>1</td>
<td>High</td>
<td>Low High High High High High</td>
<td>Moderate</td>
<td>Acidic soils, export rice to Angola</td>
</tr>
<tr>
<td>2</td>
<td>Agricultural area with small holder with maize of high productivity</td>
<td>Tourism, Sorghum, Timber, Vegetables, Cattle</td>
<td>70</td>
<td>High mhh, fhh</td>
<td>1</td>
<td>Moderate</td>
<td>Low Moderate High Moderate High Moderate</td>
<td>High</td>
<td>Acidic soils, export rice to Angola</td>
</tr>
<tr>
<td>3</td>
<td>Forested area with game management reserves, game hunting or tourism activities (including Livingstone area); small holder may benefit from employment but have restricted access</td>
<td>Tourism, Poaching, Hunting</td>
<td>100</td>
<td>Low mhh, fhh</td>
<td>Low</td>
<td>High</td>
<td>Moderate Low Moderate Low Low Low Low</td>
<td>Moderate</td>
<td>Acidic soils, export rice to Angola</td>
</tr>
<tr>
<td>4</td>
<td>Small holder farming with fishing, livestock, rice, cassava, millet, maize off season</td>
<td>Cattle, Cassava, Rice, Fishing</td>
<td>100</td>
<td>Moderate to Low mhh</td>
<td>2b</td>
<td>High</td>
<td>Low High High High High High</td>
<td>Moderate</td>
<td>Acidic soils, export rice to Angola</td>
</tr>
<tr>
<td>5</td>
<td>Smallholder with small to medium maize production, tobacco (cash crops), timber</td>
<td>Tobacco, Maize, Cattle, Timber, Grass</td>
<td>100</td>
<td>Low mhh</td>
<td>2a</td>
<td>High</td>
<td>Low High Low High Low Moderate</td>
<td>Moderate</td>
<td>Acidic soils, export rice to Angola</td>
</tr>
<tr>
<td>6</td>
<td>Small holder subsistence farmers with fruits production (pineapple)</td>
<td>Cassava, Sorghum, Honey, Cattle</td>
<td>100</td>
<td>Low mhh</td>
<td>3</td>
<td>High</td>
<td>Low High Low Low Moderate Export goats to DRC</td>
<td>Moderate</td>
<td>Acidic soils, export rice to Angola</td>
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<td></td>
<td>Pineapple</td>
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<td>7</td>
<td>Mining/farming traditional (farmers going into mining)</td>
<td>Sweet Potato, Beans, Cassava, Mining</td>
<td>100</td>
<td>Moderate</td>
<td>mhh</td>
<td>3</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
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<tr>
<td>8</td>
<td>Mining mostly (but mining closing down) and some farming</td>
<td>Mining, Labour, Commerce, Vegetables</td>
<td>40</td>
<td>50</td>
<td>10</td>
<td>High</td>
<td>mhh, fhh</td>
<td>3</td>
<td>Low</td>
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<tr>
<td>9</td>
<td>Smallholder agro pastoral – livestock, crop, millet</td>
<td>Cattle, Fishing, Tourism, Maize</td>
<td>40</td>
<td>60</td>
<td>High</td>
<td>mhh, fhh</td>
<td>2</td>
<td>Low</td>
<td>High</td>
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<tr>
<td>10</td>
<td>Agro pastoral area, with smallholder, cattle, fishing, cash crops (cotton)</td>
<td>Sorghum, Cotton, Tourism, Millet, Fishing, Wheat</td>
<td>85</td>
<td>10</td>
<td>5</td>
<td>Moderate to High</td>
<td>mhh, fhh</td>
<td>1</td>
<td>High</td>
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<td>11</td>
<td>Commercial farming (i.e. sugar) and small holders with multiple crops</td>
<td>Maize, Cotton, Cattle, Tobacco, Wheat</td>
<td>40</td>
<td>40</td>
<td>20</td>
<td>High</td>
<td>mhh, fhh</td>
<td>2</td>
<td>Low</td>
</tr>
<tr>
<td>12</td>
<td>Agro pastoral area with small holder-- maize and groundnut, cotton and tobacco, tourism</td>
<td>Maize, Groundnut, Cattle, Tourism</td>
<td>65</td>
<td>35</td>
<td>High</td>
<td>mhh</td>
<td>2</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>13</td>
<td>Small holder with subsistence farming, millet, cassava, sorghum</td>
<td>Maize, Cotton, Cattle, Vegetables</td>
<td>80</td>
<td>20</td>
<td>Moderate to High</td>
<td>mhh, fhh</td>
<td>2</td>
<td>High</td>
<td>Low</td>
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<tr>
<td>14</td>
<td>Fishing community with subsistence farming, cassava</td>
<td>Fishing, Cassava, Maize, Millet, Rice, Tourism, Vegetables</td>
<td>80</td>
<td>20</td>
<td>Moderate to High</td>
<td>mhh</td>
<td>3</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Traditional small holder, beans, millet (high altitude)</td>
<td>Beans, Cattle, Millet, Vegetables</td>
<td>80</td>
<td>20</td>
<td>High</td>
<td>mhh</td>
<td>3</td>
<td>Moderate</td>
<td>Low</td>
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<tr>
<td>15</td>
<td>Traditional small holder farmer, groundnut, cassava, maize, slash and burn</td>
<td>Cassava, Fishing, Millet, Groundnut, Soybean</td>
<td>90</td>
<td>10</td>
<td>High</td>
<td>mhh</td>
<td>3</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>16</td>
<td>Small holder, cotton, cattle, maize</td>
<td>Maize, Cotton, Cattle, Vegetables</td>
<td>80</td>
<td>20</td>
<td>Moderate to High</td>
<td>mhh, fhh</td>
<td>2</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>17</td>
<td>Traditional small holder farmers, lowland, millet, cotton, sorghum</td>
<td>Millet, Cotton, Sorghum</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
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<td>18</td>
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**Categories of farmers**

There are three major categories of farmers: smallholder (traditional) farmers cultivate less than 5 ha, use mainly hand hoes and few external inputs, and consume most of their produce. Smallholders account for 96 percent\(^1\) of Zambia’s estimated 1 100 000 farm households, farming more than 76 percent of the total cropped area. These smallholders use low-cost irrigation and water management methods. Most female farmers fall within this group.

Medium-scale farmers cultivate between 5 and 20 ha. They supplement hand hoes with oxen and tend to depend on external inputs and mechanization. They sell most of their harvest but keep some for home consumption. These farmers apply low- to medium-cost irrigation methods with mechanization. Only a small proportion of female farmers fall into this group.

Large-scale or ‘commercial’ farmers cultivate over 20 ha, mainly relying on mechanization, improved seeds, fertilizers, chemicals, animal draft power or tractors, and sell most of their production. Large-scale farmers produce most of the wheat, soybean, coffee, milk, high-value and horticultural and export crops and account for most livestock product sales. Very few female farmers can be found among commercial farmers.

According to the calculation by Thurlow et al. 2008, based on the living conditions monitoring survey of 2004, the medium- and large-scale farmers comprise 4 percent of farm households.

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\(^1\) Calculated from the LCMS, 2004 in James Thurlow *et al.* (2008) *Agricultural growth and investment options for poverty reduction in Zambia.*
4. **Detailed Description of Livelihood Zones**

Figure 2 Livelihood Zones of Zambia

4.1 **Livelihood Zone 1 (LZ1)**

This Livelihood Zone is found in the southern part of Western province. It encompasses Sesheke, Shangombo and parts of Senanga south districts and covers approximately 35,000 km². The zone falls within agro-ecological Region I, with an annual average rainfall of 800 mm and below. The growing season ranges between 150–160 days (Mitti, 1993).

Agriculture production is predominately traditional using hand hoes, and at times oxen as a source of draft power. The population in this zone is composed of vulnerable small-scale farmers growing bulrush millet, sorghum, maize and some cassava for household food security. A few keep cattle to provide milk and manure. Animals are rarely slaughtered for meat, except during special occasions such as weddings and funerals.
The Zone is endowed with natural forests with important tree species and a wide-range of wild animals. This presents great potential for developing local crafts, lumber and tourism, which currently is largely unexploited.

The rural population of LZ 1 is approximately 200,000 people. The high female population in the zone influences the type of livelihood activities prominent in the zone.

Almost all farmers found in this livelihood zone are vulnerable small-scale farmers who grow various crops for subsistence using mainly hand cultivation methods, although oxen are occasionally used.

**Location** – this LZ1 is found in four districts as mentioned above. It incorporates four distinct farming systems, i.e. FS 50, 51, 52 and 53, (Mitti, 1993); or Traditional Recommendation Domains 6,7, 8, 9 (Muwamba, 1988).

**Ethnic group** – the main ethnic groups are Mbunda, Shanjo, Mashi, Mulonga, MbuKushu Few, Lozi, Totels, Subiya, Toka, Nkoya, and Chokwe.

With respect to rainfall, the year is divided into two distinct seasons: the dry season (April–October) and the wet season (November–March). The year is divided into three periods: a cool dry season (April–July); a hot dry season (August–October); and a warm, wet season (November–March). During the cool dry season frost may occasionally occur, especially at night.

Livelihood Zone 1 lies within agro-ecological Region I, which receives less than 800 mm of annual rainfall. The growing season ranges between 150-160 days. The lowlands in the valley area along the Zambezi river experience high temperatures and humidity. The zone can be classified as suitable for growing drought-resistant crops such as millet, sorghum, sesame and cotton. Cultivation of cassava is currently limited. With irrigation, maize can be cultivated during the dry season. The zone is also suitable for raising livestock especially cattle.

The livelihood system can generally be described as a grassland area where the main crops produced form the livelihoods of many people. These are bulrush millet, sorghum, maize and cassava, which are produced by small-scale farmers using traditional hand-cultivation methods. Livestock (cattle) in the zone are kept using two management systems: sedentary and transhumance. Cattle are sometimes used as draft power for cultivation, and provide meat and milk. In addition, many farmers are engaged in fishing from the rivers (particularly Zambezi and its tributaries) to supplement their protein needs and income. Beer brewing, especially from millet and sorghum, together with handcrafts, timber and occasional cattle sales are regular livelihood activities.

**4.2 Livelihood Zone 2 (LZ 2)**

Livelihood Zone 2 is confined to Kazungula district of Southern Province and falls within Zambia’s agro-ecological Zone I. The major characteristics of this livelihood zone include, but are not limited to, about 90 percent of farm households. Maize is grown as a food staple, while only 2 percent grow cassava (Haggblade, 2008). However, according to major farming systems of Zambia (Mitti, 1993) this zone straddles parts of farming systems 41 and 52 and there is some resemblance to 40 and 39. In farming systems 41 and 52 the predominant livelihoods are based on hybrid maize, sorghum and bulrush millet cultivation also beef, milk and fish are raised. On the other hand farming systems 39 and 40 are typically the valley areas of Gwembe and Sinazonwe districts where the livelihood systems are not much different except for an added reliance of the surrounding communities on game meat.

To a small degree, in order to diversify household income, rural communities in this zone harvest high-value non-timber forest products (NTFPs). These include: i) harvesting seasonal mushrooms; ii)
collecting Mopane worms; iii) harvesting Mungongo nuts for its oil; iv) carrying out traditional bee keeping; v) collecting baobab fruit and Mubuyu fruit to sell in Lusaka and other urban markets; and vi) harvesting thatch and palm fronds for basket and mat making.

The dominant ethnic groups found in the zone are Tonga and Toka in the north, Lozi, Subiya and Totela in the southwestern part of the district. The farm households are male dominated (65%) with the remainder 35 percent are female headed. Regarding the distribution of the farming population, LZ 2 consists of about 70 percent traditional subsistence farmers followed by 25 percent emergent and 5 percent can be considered to be commercial farmers.

Because of its proximity to the town, Livingstone, which is a centre for tourism, this livelihood zone has relatively good road infrastructure; the tarred Livingstone–Sesheke road passes through it. Other communication facilities include telecommunication (mobile phone networks), links to neighbouring Botswana through the Kazungula pontoon. Although, currently, Livelihood System 2 may not directly benefit from electricity, the 33 kv power line from Livingstone to Sesheke is near by. Other services in the area are the public services provided by government institutions such as the Ministries of Agriculture and Cooperatives, Education and Health.

Generally, although the zone lies in the low rainfall area, with poor soils, livestock rearing is possible because of abundant pastures in the river basins where flooding occasionally occurs as rivers burst their banks. In the northern part of the zone, which lies on the plateau where there are more fertile soils, some semi-commercial farming is practiced using oxen cultivation.

4.3 Livelihood Zone 3 (LZ 3)

This zone covers wooded areas with game management reserves, game hunting or tourism activities of Livingstone, Kasempa, southeast Solwezi and parts of Lufwanyama and Mufumbwe districts.

According to major farming systems of Zambia (Mitti, 1993) a total of five distinct farming systems are involved; namely FS 39 and 40, which are typical drought-prone valley areas mainly covering Livingstone district, and FS 6, which is largely maize/sorghum based with some amount of fishing near swamps, FS 32 and parts of FS 33. In the latter two systems both sorghum and finger millet, with some maize provide important starchy food crops for the people.

The crop growing season varies from a low of 90-100 days with 70 percent probability, 4-5 dry (< 30 mm) 10 day periods, slight frost risk in winter and mean monthly minimum temperature between 18 and 19 °C in Livingstone to a high of 140–170 days with 70 percent probability, slight frost risk in winter, restricted (700–850 hours) sunshine within the rainy season and mean monthly minimum temperatures of between 16 and 17 °C during December to February in Kasempa and Solwezi districts. This allows a wide variety of livelihoods to be practiced. Apart from the above-mentioned starch food crops grown, other crops of economic importance are vegetables and beans. Around Livingstone, commercial production of chilies and irrigated maize and wheat is gaining recognition.

Other livelihood cash sources in this system include beer from sorghum and millet, vegetables, fish, game meat, honey and livestock (chicken) sales. In addition, tourism and game hunting form important livelihood activities.

The main ethnic groups in the zone are Kaonde, Lamba and Tonga speaking people. Almost 100 percent of farm households are male headed/dominated.

Soils of this zone can be described as poor because of the inherent soil infertility brought about by nutrient leaching resulting from the high rainfall in Solwezi, Kasempa and Mufumbwe districts.
Veldkamp (1987) described these soils as strongly leached, very strongly acid, red to reddish clayey and slightly silty soils (with clayey to fine loamy top soils), usually with low retention capacity, derived from acid rocks in Miombo vegetation. The soils around Livingstone have poor water-holding capacity and low fertility because of their sandy nature. According to Veldkamp, these are shallow soils with fine loamy to clayey topsoils on basalt in Mopane vegetation.

4.4 Livelihood Zone 4 (LZ 4)

Livelihood Zone 4 is found in Kalabo, Lukulu and west of Kaoma, Senanga and Mongu districts in agro-ecological region II b of Western Zambia. In general, the zone consists of 100 percent smallholder traditional farmers practicing fishing, livestock keeping and the cultivation of rice, cassava, millet and off-season maize. However, cattle rearing, cassava, rice, beer brewing, crafts and fishing are important livelihood activities.

Agro-climatically LZ 4 experiences a wide-range (110–150) days of growing season with 70 percent probability occurrence of 3–4 dry (< 30 mm) 10 day periods, slight to serious frost occurrence in Kaoma, Mongu and Senanga and mean monthly minimum temperature between 18 and 19 °C during December to February.

Six farming systems are recognised. These are FS 45 in west Kaoma district characterized by a combination of river-based and upland settlements comprise a cattle, cassava/sorghum and fish-based system. FS 46 and 47 cover Kalabo west and the flood plains of both Kalabo and Lukulu districts respectively, which comprise basically cattle/fish-based systems. The other FS 48 is found in the central Zambezi flood plain of Mongu and Senanga districts, while FS 49 covers the plains of Lukulu west and north of Liuwa plains in Kalabo with settlements in Luanginga and Lwangembungu rivers. FS 50 covers west of Zambezi river, which stretches west to Senanga and Seshihe districts as well as southwest of Kalabo district.

The dominant ethnic groups in the zone include Kwangwa, Nyengo, Mwenyi, Mbunda, Lwalange, Lozi, Luvale, Nkoya, Chokwe, Lunda, Shanjo Mashi, Mulonga, Mbukushu and Fwe.

Although the population density in this zone has been described elsewhere as medium to low, the proportion of female-headed households is relatively high about 25-40 percent of the total farm households.

Livelihood Zone 4 encompasses river basins and flood plains characterized by inaccessible remoteness, labour shortages, and drought-prone areas with chronic food insecurity. The soils are mainly podzols that are imperfectly to very poorly drained, very strongly to medium acid, coarse sandy to coarse loamy soils (with coarse sandy top soils) in large valley dambos and hydromorphic plains. In addition to the above, in Kaoma district there are moderately to strongly leached, to medium acid, well-drained, reddish to yellowish, loamy to clayey soils, (with coarse loamy to clayey top soils) and poorly to very poorly drained soils of variable texture and acidity occurring in large depressions or valleys are common.

4.5 Livelihood Zone 5 (LZ 5)

Livelihood Zone 5 incorporates Kaoma, North East Lukulu, and some parts of North East Seshihe districts in agro-ecological region II a. Almost 100 percent of all smallholder farms are owned by traditional farmers who depend on maize, cassava, sorghum bulrush millet and sweet potatoes as staple crops. The livelihood zone can best be described as a multi-staple crop system where hired labour and oxen play a vital role in crop production. Tobacco, timber and grass form part of the livelihood cash income activities.
Mitti, in his description of the major farming systems of Zambia, delineates this livelihood zone as four distinct farming systems: FS 42, 43, 44 and 53. Both FS 42 and 43 are found in Kaoma district. This domain has a relatively well-developed communication network compared to FS 44 and 53 found in Lukulu and Seshike districts. The latter is characterized by poor infrastructure with sparse population concentrated along a few permanent sand tracks.

Agro-climatically LZ 5 is similar to LZ 4 described above with the exception of Seshihe, which experiences a shorter growing period of 90–100 days with a 70 percent probability, occurrence of 4-5 dry (< 30 mm) 10 day periods within the growing season, with serious frost risk in winter and mean monthly minimum temperature between 18-19 °C during December to February.

Soils of LZ 5 are similar to those described for LZ 4 above.

The main ethnic groups found in the zone include Lozi, Nkoya, Luvalle, Mbunda, Luchazi, Chokwe and Toka tribes with about 20–40 percent of households being female headed.

4.6 Livelihood Zone 6 (LZ 6)

Livelihood Zone 6 is located in Mwinilunga, Kabompo, Zambezi and Chavuma districts of Northwestern province. It lies in agro-ecological region III receiving annual precipitation in excess of 1000 mm. Because of the high rainfall, which leads to soil nutrients leaching, the soils in the zone are generally acidic and hence infertile. According to Soils of Zambia (second edition), six soil units are recognized in LZ 6. These are unit 3 or shallow soils derived from acid rocks, occurring on hills or hilly ranges; unit 7 or strongly leached, very strongly acid, red to reddish brown clayey to loam soils in Miombo vegetation; unit 9 or moderately leached, strongly to medium acid, reddish brown clayey to loamy soils (with sandy to coarse loamy top soils); unit 19 or non to weakly podzolic, very strongly acid, coarse sandy soils (podzols) (with coarse sandy top soils) in a pan dambo area on Kalahari sands; unit 22 or imperfectly to very poorly drained, very strongly to medium acid, coarse sandy to coarse loamy soils (with coarse sandy top soils) in large valley dambos and hydromorphic plains and unit 23, which is an association of non to weakly podzolic, very strongly to slightly acid, coarse sandy to coarse loamy soils and poorly to very poorly drained, very strongly to medium acid, sandy to coarse loamy soils in large dambos or plains. Unit 19 is widespread in LZ 6.

The growing season has a 70 percent probability of rainfall within a range of 140–180 days with low (< 700 hours) of sunshine during the rainy season. The probability of occurrence of dry (< 30 mm) 10-day periods increases from 1–3 from the northern part of the zone towards the southwest into Kabompo and Zambezi/Chavuma.

According to major farming systems of Zambia, this zone is described as cassava-based traditional subsistence farming system. In other words, the chief staple crop is cassava, which is adapted to the poor soils and long growing season in the zone. However, other crops grown include maize, beans, groundnuts, rice, sweet potatoes and pineapples. Some cattle are kept in Mwinilunga and Zambezi districts. Off-farm livelihood activities found in the zone are honey, fishing and game hunting.

The dominant ethnic groups are Lunda, Luchazi, Luvalle, Chokwe Nkoya, and Mbunda. Although farm households among these ethnic groups are mainly male dominated, a few (31 %) are female headed.

The zone lies in remote and undeveloped parts of the country with poor communication infrastructure. With regard to accessibility to agricultural land, LZ 6 has moderate to poor accessibility. National forest, national park or game management areas cover much of the zone.
4.7 Livelihood Zone 7 (LZ 7)

Livelihood Zone 7 covers Solwezi, Kasempa and Northern parts of Mufumbwe districts in Northwestern province. Like LZ 6, it falls within agro-ecological region III. Veldkamp (1987) identified five distinct soil units. These are units 7, 9, 11, 19 and 24. Generally, these are strongly leached and very strongly acid clayey or coarse sandy soils. In some parts of the zone (Kasempa) shallow, moderately well to imperfectly drained, loamy soils (with sandy to coarse loamy topsoil) over laterite occur.

Agro-climatically LZ 7 has a growing season of 130–180 days with slight risk of frost especially in dambo areas, restricted (700–850) hours of sunshine in the rainy season and mean monthly minimum temperature between 16 and 18 °C during December to February.

Although the farming system, according to the Adaptive Research Planning Team-North Western Province (ARPT-NWP), is sorghum-based in which sorghum forms the chief staple crop, other important crops grown include sweet potatoes, beans and cassava. Mining is a non-farm livelihood activity, which is increasingly gaining prominence especially in Lumwana area of Solwezi district. Other income sources are beer brewing from sorghum and millet, game meat, honey and selling livestock, i.e. goats mainly to neighbouring Democratic Republic of Congo.

In all three districts Kaonde is the dominant ethnic group. However, Lamba forms a significant proportion of the population in the eastern parts of Solwezi district. About 15 percent of farm households in the zone are female headed.

Generally communication facilities, especially road infrastructure connecting districts’ headquarters, are better than in LZ 6 above. However, feeder roads in the hinterland remain poor making access to agricultural production areas and market difficult.

4.8 Livelihood Zone 8 (LZ 8)

The entire Copperbelt province constitutes Livelihood Zone 8 and falls within agro-ecological region III, which receives an average annual rainfall of approximately 1 300 mm. It has a long (130–160) days growing season with a slight risk of frost in winter (June–August) and a mean monthly minimum temperature between 17 and 18 °C during December to February.

According to the Soils Map of Zambia, one soil unit (7) is predominant and a few places where soil unit 10a occurs. Soil Unit 7 represents strongly leached, strongly to very strongly acid, clayey to loam soils, derived from acid rocks with top soil pH (CaCl₂) of 4.0–5.5 and subsoil acidity status of pH 4.0–6.0 in the Miombo vegetation, while, soil unit 10a is moderately to strongly leached, to medium acid, red, clayey soils derived from basic rocks and pH (CaCl₂) of 4.5–6.0.

There are two farming systems peri-urban and Mpongwe. The peri-urban is mainly found in and around the urban towns of Ndola, Mfulira, Chingola, Kitwe, Kalulushi and Chililabombwe. Its characteristic features are the high numbers of retired miners and workers/settlers whose livelihood is trading, sale of clothes and vegetables production. The Mpongwe farming system is found in the rural districts of the province, including Luanshya, Masaiti, Mpongwe and Lufwanyama, where a wide-range of starch staples including maize, sorghum, cassava and millet are grown. Limited cash crops such as soya beans, cotton and sunflower and, to a limited extent, coffee are also important.

Although a few mines have recently closed, rendering many unemployed, mining together with commerce still remain the most important livelihood activities in this zone.
In the urban districts ethnic groups are mixed since most are migrant workers from all parts of the country who drifted to Copperbelt in search of employment in the copper mines. Lamba/Lima ethnic groups dominate rural areas of the livelihood zone.

In the zone about 40 percent are traditional subsistence farmers; followed by 50 percent emergent and 10 percent may be considered to be commercial farmers.

Communication facilities are relatively better in this zone and access to markets is relatively easy.

### 4.9 Livelihood Zone 9 (LZ 9)

Two districts of Itezhi-tezhi and Namwala of Southern province fall within this livelihood zone. The zone forms part of agro-ecological region II b and the annual precipitation is between 800–1000 mm. The length of the growing period is 110–120 days. During this time 2–3 dry (<30 mm) 10 day periods have a 70 percent chance of occurring. The zone may experience serious frost between June and August and the mean monthly minimum temperature is between 17 and 18 °C from December to February.

The soils found in this zone are mainly moderately leached, strongly to medium acid, reddish to brownish clayey to loamy soils derived from basic rocks often in admixture with acid rocks, podzols in a pan dambo area on Kalahari sands and imperfectly to very poorly drained, slightly acid to alkaline, clayey floodplain soils with variable texture and acidity.

This zone consists of smallholder agro-pastoralists, whose chief livelihood revolves around cattle rearing, fishing, tourism, millet and some maize production. According to major farming systems of Zambia Livelihood Zone 9 fits into the general description of Plateau Ox System of southern province. A mix of cash crops, food crops and livestock characterizes this system. It has relatively good access to agricultural inputs and capacity to expand production. The major cash crops grown are hybrid maize and sunflower. The major food crops are maize (local and hybrid), groundnuts, sweet potatoes, sorghum, local and exotic vegetables, cowpeas, Bambara nuts, beans and pumpkins.

Livestock is important especially for milk and draught power. However, farmers also keep other livestock species, e.g. goats, chickens, guinea fowls and at times pigs. An important feature of this zone is its great potential for tourism especially in Itezhi-tezhi district, which forms part of the Kafue National Park.

The Ila/Tonga are the dominant ethnic groups in the livelihood domain. Rural population density is moderate to high and predominately male headed at approximately 96 percent.

There are two traditional farmer categories, making up 40 percent of total households and the remainder 60 percent are emergent farmers.

Access to agricultural production areas is poor with most of the land area in the zone falling under national parks and game management areas.

### 4.10 Livelihood Zone 10 (LZ 10)

This Livelihood Zone comprises three districts in Southern Province: Gwembe, Siavonga, Sinazongwe. Luangwa district in Lusaka province is also part of this livelihood zone. Basically LZ 10 is found in valley areas or agro-ecological region I, which are drought prone receiving less than 800 mm precipitation per annum. This zone is located in rural to remote parts of the country making access to agricultural production areas and markets difficult.
Although maize is planted, sorghum does much better in LZ 10. The zone is characterized by poor infrastructure, hilly and rocky shallow soils and is usually infested with tsetse fly, limiting cattle rearing. Therefore, LZ 10 can best be described as an agro-pastoral area, with smallholders, cattle, fishing, cash crops (cotton) forming the major sources of cash for community livelihoods.

Agro-climatically, LZ 10 has a growing period of 80 to 100 days with 3 to more than 5 dry 10-day periods during the growing season and a mean monthly minimum temperature between 20 and 21 °C during December to February.

The soils of LZ 10 are predominately slightly acid to alkaline, (Rift) valley loamy and clayey soils (with coarse to fine loam top soils) occurring in gently undulating areas in Mopane, Munga and Baikiaea vegetation. In addition, shallow and gravelly soils, derived from acid rocks, occur in rolling to hilly areas, including escarpment zones in Miombo vegetation.

The Tonga, Goba and Chikunda are major ethnic groups found in Livelihood Zone 10. However, Soli and Lenje form a significant proportion of population in parts of Luangwa district.

Three farmer categories are identified in LZ 10, 85 percent can be classified as traditional farmers with 10 percent emergent and the remaining 5 percent as commercial. Moderate to high rural population density is evident with a majority of households being male headed and or dominated.

### 4.11 Livelihood Zone 11 (LZ 11)

This is probably one of the largest livelihood zones identified. It comprises nine districts: Kalomo, Choma, Monze, Mazabuka, Lusaka, Kafue, Chongwe, Chibombo and northeast Kapiri Mposhi. Livelihood Zone 11 is located in the central plateau and has the best soils and climate for agricultural purposes. It falls within agro-ecological region II, which receives annual rainfall of 800–1 000 mm.

Agro-climatically its growing season is lowest in the southern part of the zone, i.e. Kalomo where it falls within 100–110 days with a 70 percent probability occurrence of 3–4 dry (< 30 mm) 10-day periods during this season and serious frost risk in June to August, and mean monthly minimum temperature between 16 to 17 °C from December to February. This growing season increases to a high of 130–140 days with slight frost risk and a mean monthly minimum temperature 17 to 18 °C in Kapiri Mposhi.

Two major soil units are found in LZ 11. Veldkamp (1987) described these as soil units 9 and 12. Soil Unit 9 is moderately leached, strongly to medium acid, reddish to brownish, clayey to loamy soils (with sandy to coarse loamy top soils), derived from acid rocks in Miombo vegetation while, soil unit 12 is described as slightly leached, medium to slightly acid, red to reddish, clayey soils (with fine loamy to clayey top soils), derived from basic rocks, often in admixture with acid rocks in Munga vegetation.

(Mitti, 1993) identified seven distinct traditional recommendation domains of farming systems: FS 3, 4, 5, 7, 25, 26 and 41. The first four systems are found in the northern part of the livelihood zone. The following features distinguish the systems, i.e. FS 3 is hand-hoe cultivation with some limited ox-hire. Sorghum, millet and some maize are important staple crops. Selling of millet beer, temporary jobs (piece work) and charcoal sales form important livelihood activities. On the other hand FS 4 has predominant use of oxen for both cultivation as well as farm transportation. A wide-range of crops is grown with maize, sorghum finger millet and sweet potatoes as starch foods. Beans, vegetables, groundnuts and fish form important diet ingredients. However, maize also forms the main cash source together with beer sales.
Farming system 5 is dominated by semi-commercial (emergent) farmers and cattle ownership is widespread. Maize forms the major starch staple, supplemented by sweet potatoes and some sorghum. Beef, chicken and fish, together with vegetables form the common diet of the people. FS 7 is a homogeneous single domain of emergent farmers who use cattle and oxen technologies and hire tractors. As in the other three systems described in this zone, maize forms the major starch staple with sorghum used for beer brewing. Cash crops in the system include maize, cotton and sunflower. The remainder FS 25, 26, and 41 are found in the central and southern parts of the zone. Farming Systems 25 and 26 is semi-commercial characterized by maize as a major starch staple, oxen and tractor power, and production of cash crops such as sugar cane, cotton, sunflower and vegetables forming important livelihood activities in the zone.

FS 41 is described by Mitti (1993) as plateau ox-systems, characterized by a mix of cash crops, food crops, and livestock. The main cash crops include hybrid maize, sunflower, cotton, and tobacco, while food crops are local and hybrid maize, groundnuts, sweet potatoes, sorghum, local and exotic vegetables, cowpeas, Bambara nuts, beans and pumpkins. Livestock is important for milk and draft power.

The Swaka, Lala, and Bemba form the main ethnic groups in the northern part of LZ 11 while, Lenje and Tonga are found in the southern part. The central part of the zone has a mixed ethnic group. In all ethnic groups, households are male headed/dominated.

Three farmer categories are identified: traditional, emergent and commercial in the following proportions 40:40:20 respectively.

Communication infrastructure in the zone is comparatively better than most zones described so far except in the extreme north (Serenje, Mkushi), where communication is poor and presents difficulties to the farming communities accessing both inputs and markets for agricultural.

4.12 Livelihood Zone 12 (LZ 12)

Livelihood Zone 12 covers most of Eastern Province (Chama, Lundazi, Chipata, Chadiza, Katete, Petauke, Nyimba) in agro-ecological region II and Isoka district in Northern Province in agro-ecological region III. Therefore, in terms of rainfall most of LZ 12 receives between 800–1 000 mm with Isoka having in excess of 1 000 mm per year. This entails a crop-growing season of 100–150 days moving from south to north in the zone with a 70 percent probability occurrence of 3 4 dry (30 mm) 10-day periods in Nyimba and low (less than 700) sunshine hours during the rainy season and mean monthly minimum temperature between 14 15 °C during December to February in Isoka.

According to Soils of Zambia (Veldkamp, 1987), nine soil units are identified in LZ 12. These include shallow/association of shallow and gravelly soils derived from acid rocks, occurring in rolling to hilly areas, including escarpment zone in parts Isoka, Chama, Lundazi and Nyimba districts through moderately leached, strongly to medium acid, reddish to brownish, clayey to loamy soils (with sandy to coarse loamy top soils), derived from acid rocks in Miombo vegetation and slightly leached, medium to slightly acid, red to reddish, clayey soils (with fine loamy to clayey top soils), derived from basic rocks, often in admixture with acid rocks in Munga vegetation of Chipata, Chadiza, Katete, Petauke and Nyimba districts.

This Livelihood Zone 12 is divided into the plateau, the escarpment (relatively uninhabited) and the valley. In the valley finger millet is widely grown in Luangwa Chama in the north, sorghum and maize are important in Luangwa Central and local maize in Luangwa South. All valley areas are labour dependent since no animal draught is used because of tsetse fly and trypanosomiasis. However, this area has very high tourism potential. On the plateau farmers are grouped into either ox or hoe...
cultivators with local maize and groundnuts being major crops. Overall, 65 percent of farmers in LZ 12 fall into the traditional category with the remainder 35 percent being categorized as emergent farmers.

The main ethnic groups include Chewa, Ngoni, Nsenga, Tumbuka, Senga, Kunda, Bisa, Chikunda, Mambwe and Namwanga. A majority of households in these ethnic groups are male headed with a high rural population.

Communication infrastructure in the zone is comparatively fair except in parts of the valley areas where this is poor and presents difficulties to the farming communities to access both inputs and markets for agricultural purposes.

4.13 Livelihood Zone 13 (LZ 13)

Serenje District of Central province comprises LZ 13. This means that the zone lies in agro-ecological region III receiving annual rainfall in excess of 1 000 mm. Agro-climatically it has a long crop growing season of 120–160 days with slight frost risk occurrence especially in dambos during June to August and restricted (700–850) sunshine hours during the rainy season and mean monthly minimum temperature 16 to 17 °C from December to February.

The Soils of Zambia (1987) identified and described six soil units in the district. These include (Units 2, 3, 8, 9a, 26 and 31), which range from shallow and gravelly soils derived from acid rocks, occurring in rolling to hilly areas, including escarpment zones in the south through moderately leached, strongly to medium acid, reddish to brownish, clayey loamy soils derived from acid rocks to rift valley soils of variable texture in the Mopane, Munga and Miombo vegetation in the north.

According to the major farming systems of Zambia (1993) Serenje district has a mixture of Chitemene system of cultivation in the north, hand-hoe cultivation supplemented by ox hire in the central and southern parts. Both cassava and finger millet form major starch staples supplemented by rice and sweet potatoes. The system’s main livelihood activity is the brewing of millet beer, fish, followed by temporary piecework and charcoal sales.

However, with the establishment of the Farming Block at Nansanga in the district it is expected that a dramatic change in farming systems will occur and people’s livelihoods will be transformed to a more organized semi-commercial and market-oriented systems and enterprises.

Most of the zone is characterized by poor communication facilities, especially north of Serenje. The central part of the zone has, however, better road networks for the transportation of in input and produce marketing.

The dominant ethnic groups are Lala and Swaka whose population density as recorded by IFAD/WFP (1993) is less than 5 persons/km². Although women out number men the population, remains widely male dominated.

4.14 Livelihood Zone 14 (LZ 14)

Livelihood Zone 14, comprised of Samfya, Chilubi, Nchelenge north, Chiengi, Kaputa, and Mpulungu districts, is generally described as LZ of fishing communities with subsistence farming where cassava is an important crop. This zone lies in agro-ecological region III, which receives annual precipitation in excess of 1 000 mm. It experiences a long crop growing period of 140 to 160 days with a 70 percent probability occurrence of 1–2 dry (< 30 mm) 10-day periods, restricted (700–850) sunshine hours in the rainy season and a mean monthly minimum temperature of between 19 to 20 °C during December to February.
The soils in LZ 14 range from shallow or associations of shallow gravelly soils derived from acid rocks occurring in rolling to hilly areas and shallow to deep, strongly leached acid, reddish to brownish clayey to loamy soils; derived from acid rocks in Miombo vegetation, through to very strongly leached, very strongly acid, reddish, loamy to dark brownish loamy to clayey soils with fine loamy top soils derived from acid rocks. Associations of very strongly leached, very strongly acid, well-drained, brownish to yellowish, loamy to clayey in Miombo vegetation and poorly drained floodplain soils of variable texture and acidity in lake Basin Chipya vegetation surrounded by swamp or grassland.

According to Mitti (1993), the farming systems are: i) Lakes depression system, ii) Chambeshi-Bangweulu (marshlands) systems in Samfya district and iii) grass mound cultivation system in parts of Nchelenge and Mbulungu districts. The first two systems are based on cassava and fish. Cassava is mainly grown on mounds in permanent fields, while fishing provides a major livelihood source of income. In addition, rice is an important cash crop in the marshlands. The third system is a grass mound (Fundikila) system with maize and beans as major crops. Some finger millet and cassava are also grown as starch staples. Cattle are kept for protein, draft power and cash.

The ethnic groups found in LZ 14 include Ng'umbo, Mambo and Makulu in Samfya, Lunda, Aushi in Nchelenge and Chienge districts.

Communication facilities within LZ 14 vary from poor in and around the swampy areas of Samfya to moderately fair in Lake Bangweulu area and comparatively good in Mbulungu district.

4.15 Livelihood Zone 15 (LZ 15)

Mbala and Nakonde in Northern Province form LZ 15. Agro-climatically the zone experiences a long growing season 140–170 days with a 70 percent probability, 1–2 dry (< 30 mm) 10-day periods within the growing season with less than 700 sunshine hours in the rainy season (especially in Mbala) and a mean monthly minimum temperature between 14 to 15 °C during December to February.

The soils range from shallow and gravelly soils derived from acid rocks through associations of shallow soils occurring on hills, and moderately leached, strongly to medium acid, reddish to brownish clayey to loamy soils derived from basic rocks in Miombo vegetation. In addition, strongly leached, strongly acid, red clayey soils with low retention capacity derived from acid rocks to brownish clayey and loam soils all in Miombo vegetation are common.

According to Mitti (1993), two distinct farming systems are identified. These are the Chambeshi – Bangweulu (marshlands) and grass mound cultivation systems. These systems have been adequately described in LZ 14 above. LZ 15 is 80 percent traditional smallholders and the remainder 20 percent emergent farmers in high altitudes growing mainly beans and millet. Cattle and vegetables are also important livelihood activities in the system.

The Mambwe and Namwanga are the main ethnic groups in the zone.

The population density is relatively high, i.e. greater than 100 people per km² in Mbala and 25–100 people per km² in Nakonde (IFAD/WFP, 1993), with male-headed households. The zone’s proximity to border areas with neighbouring Tanzania and Lake Tanganyika is probably a contributing factor. Communication facilities are relatively fair to allow easy access to agricultural inputs and delivery of inputs and products to markets.
4.16 Livelihood Zone 16 (LZ 16)

This is one of the largest livelihood zones identified. It covers a total of 10 districts in Northern and Luapula provinces. Agro-climatically LZ 16 falls in the high rainfall region III. The growing season ranges from a low of 140 days in Mpika, Chinsali and Mwense to a high of 200 days in Kawambwa. Part of the zone has a 70 percent probability of 1-2 dry (< 30 mm) 10-day periods during the growing season in Mwense, restricted (700–850) sunshine hours during the rainy season in seven out of the ten districts and a mean monthly minimum temperature of between 19 and 20 °C during December to February. The remaining districts of Kawambwa, Mporokoso, Luwingu, receive less than 700 sunshine hours during the rainy season and experience lower mean monthly minimum temperatures between 16 and 17 °C during December to February.

The soils of LZ 16 are mainly strongly leached, strongly to very strongly acid, red to brownish clayey to loam soils, derived from acid rocks in Miombo vegetation and association of shallow soils occurring on hills, and shallow to deep, strongly leached, to very strongly acid, reddish to brownish, clayey to loamy soils, derived from acid rocks too in Miombo vegetation. In parts of LZ 16 (Milenge District) there is association of (very) strongly leached, very strongly acid, well-drained, brownish to yellowish, loamy to clayey in Miombo vegetation and poorly drained floodplain soils of variable texture and acidity in Lake Basin Chipya vegetation and swamp grassland of Kawambwa district.

There are two distinct farming systems in LZ 16, which have been described by Mitti (1993). These are the Plateau Chitemene system and Lakes Depression system. The first system is characterized by extensive shifting cultivation (Chitemene) based on finger millet, cassava, beans and some groundnuts. The latter on the other hand is mainly based on cassava and fish. Therefore, finger millet and cassava form the major starch staples along with beans and groundnuts. Important livelihood activities on the plateau include selling maize, groundnuts and beans while, in the Lakes Depression system fishing is the primary livelihood engagement.

Ninety percent of farmers in this zone are classified as traditional smallholders practicing shifting cultivation and the remaining 10 percent are emergent and engaged in hybrid maize and soybean production.

The ethnic groups Bemba, Chishinga, Lunda, Aushi, and Ng’umbo are dominant in the zone.

4.17 Livelihood Zone 17 (LZ 17)

Livelihood Zone 17 is found in Central and Copperbelt provinces and comprises Chibombo, Mumbwa, Kapri Mposhi West and Mpongwe districts. The first three districts are in agro-ecological region II, while Mpongwe is in region III. As a result the zone experiences a medium to long growing season of 110 days in Chibombo and Mumbwa and 150 days in Mpongwe.

The common soil type found in this zone belongs to what Veldkamp (1987) described as moderately leached, strongly to medium acid, reddish to brownish, clayey to loamy soils derived from acid rocks in Miombo vegetation.

Four distinct farming systems are found in LZ 17: i) hand-hoe cultivation with some ox-hire characterized by sorghum growing as the major staple crop followed by finger millet (widely used for beer) and some maize, ii) semi-commercial system characterized by wide-spread cattle ownership and use for draft purposes, maize is the major starch staple, supplemented by sweet potatoes and some sorghum. Maize is predominantly the cash source and fish plus beer are also important livelihood activities, iii) emergent farmers’ system is characterized by cattle ownership, use of oxen technologies and tractor hire. In this system maize is a major starch staple supplemented by sorghum (important for beer). Cash crops include maize, cotton and sunflower, iv) the Mpongwe
system, which is a mixed maize-sorghum-cassava system. Cash crops include cotton, soybeans, sunflower and to a lesser extent coffee.

Farmers in LZ 17 can be classified as traditional smallholders and comprise 80 percent and the remaining 20 percent are emergent farmers who grow cash crops such as hybrid maize, cotton, vegetables and rear livestock (cattle).

A mixed ethnic grouping is common in this zone.

4.18 Livelihood Zone 18 (LZ 18)

Livelihood Zone 18 is comprised of northeast Nyimba, southeast Serenje, southeast Mpika and Mambwe and part of Chama districts. The zone, therefore, has some elements of both agro-ecological region I (Chama, Nyimba and Mambwe) and region II (southeast Serenje and southeast Mpika).

Agro-climatically LZ 18 has a short growing season of between 90–130 days with a 70 percent probability occurrence of 4 to > 5 dry (< 30 mm) 10-day periods within the growing season and mean monthly minimum temperature between 20 and 21 °C during December and February.

The soils of LZ 18 are mainly a combination of shallow and gravelly soils derived from acid rocks occurring in rolling to hilly areas, including escarpments in Miombo vegetation. In addition there are Rift Valley soils of variable texture in Mopane, Munga and Miombo vegetation and slightly acid to neutral, loam and clayey, alluvial soils occurring along tributary rivers usually in Munga vegetation.

According to major farming systems, LZ 18 is covered by the Luangwa valley systems, which is further divided into three distinct subsystems: Luangwa North (Chama) where finger millet is widely grown, Luangwa Central where sorghum and maize are important and, Luangwa South where the only important cereal crop is local maize (Mitti, 1993). In addition, in North Luangwa farmers are beginning to grow cotton as a cash crop. However, hunting and gathering are major off-farm/livelihood activities. There is great potential for development and promotion of tourism.

The dominant ethnic groups in the zone include Senga, Kunda, Bisa, Chikunda, Nsenga, Lala and Swaka.

The valley areas generally have very poor communication facilities because of their remoteness and most are reserved for wild life.
5. APPLICATION OF THE LIVELIHOOD ZONES

5.1 Investment potential through AWM interventions in livelihood zones

The synthesis map in Figure 2 above was analysed simultaneously by four thematic groups each looking at one criterion and scoring its relative importance (high, medium, or low). The following criteria were considered important in order analyse to targeted investments in AWM solutions:

1. **Rural poverty** – high poverty, medium poverty, low poverty (better off).
2. **Water development** – high potential for developing water, medium or low potential.
3. **Water as critical factor for livelihoods** – high dependence on water availability for their livelihoods (the activity is based on water availability), medium dependence or low dependence (even if in arid context, the activity may not be dependent on water availability).
4. **Market access** – high connection to markets (road density), medium (pockets isolated but a network available) or low (isolated).

The results of each group were discussed and validated or revised in plenary. On this basis, the most relevant agricultural water management solutions (5) were discussed, starting with those designated as a priority, which were indicated at the National Consultation.

(1) *in situ* seepage and recession systems (flood recession/dambos);
(2) conservation agriculture;
(3) diversion weirs;
(4) wetland canals;
(5) individual farmer low-cost technology (treadle, rope, and washer, drips);
(6) individual motorized pumps;
(7) communal pumping; and
(8) small dams/reservoirs.

As a comparison, the column 6 recalls the AWM solution that obtained the highest ranking per AEZ zone (ranking above 5).

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2 The investment potential is defined as potential to contribute to poverty reduction and improving rural livelihoods through AWM investments.
Table 2 – Livelihood zones and criteria to target AWM interventions

<table>
<thead>
<tr>
<th>No.</th>
<th>AEZ</th>
<th>Poverty</th>
<th>Water development</th>
<th>Dependence on water</th>
<th>Market access</th>
<th>AWM solution</th>
<th>Refer to NC-AEZ ranking AWM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>high</td>
<td>high</td>
<td>high</td>
<td>low</td>
<td>pumping gw (motor)</td>
<td>(2); (5); (6), (8)</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>medium</td>
<td>medium</td>
<td>medium</td>
<td>low</td>
<td>water harvesting</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1/2</td>
<td>low</td>
<td>medium</td>
<td>low</td>
<td>high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2b</td>
<td>high</td>
<td>high (but acidic soils)</td>
<td>high</td>
<td>low (but close to Angola importing rice; and to Namibia)</td>
<td>pumping and irrigation/ wetland</td>
<td>(5) (2) ; (8)</td>
</tr>
<tr>
<td>5</td>
<td>2b</td>
<td>high</td>
<td>high</td>
<td>low</td>
<td>low</td>
<td>small dams / dambo mgt</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>high</td>
<td>high</td>
<td>low</td>
<td>low (but next to Congo importing goats)</td>
<td>irrigation</td>
<td>(3) (5)</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>high</td>
<td>high (but sour dambos / acidic soils)</td>
<td>low</td>
<td>medium (market in the mining areas)</td>
<td>irrigation</td>
<td>(6)</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>high (market of mining areas)</td>
<td>irrigation mgt (veg) and water for dairy</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>2a</td>
<td>high</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td></td>
<td>same as 2b</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>high</td>
<td>high (but water quality pb)</td>
<td>low</td>
<td>low</td>
<td>pump from lake to irrigate ; market</td>
<td>same as above</td>
</tr>
<tr>
<td>11</td>
<td>1/2a</td>
<td>low</td>
<td>high</td>
<td>medium</td>
<td>medium (but many farmers live far from the roads)</td>
<td>value chain for small-holders</td>
<td>same as 1 above</td>
</tr>
<tr>
<td>12</td>
<td>2a</td>
<td>medium</td>
<td>low</td>
<td>medium</td>
<td>medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>high</td>
<td>medium</td>
<td>low</td>
<td>low</td>
<td>fishermen to farming</td>
<td>(3) (5)</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>high</td>
<td>medium</td>
<td>high (close to Tanzania and Congo markets)</td>
<td>fish farming</td>
<td></td>
<td>(6)</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>medium</td>
<td>high</td>
<td>high (beans rainfed)</td>
<td>low (but Tanzania beans and onions for Congo transit through there) ; and good area for beans</td>
<td>value chain (beans for export) ; plant twice with irrigation (first for seeds, then for export)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>3</td>
<td>high</td>
<td>high</td>
<td>low (mainly rainfed)</td>
<td>medium (Tanzanian market)</td>
<td>small irrigation from river</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>2a</td>
<td>medium</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>irrigation</td>
<td>same as 2b</td>
</tr>
<tr>
<td>18</td>
<td>1/2a</td>
<td>high</td>
<td>medium</td>
<td>high</td>
<td>low</td>
<td>pump from river, market / tourism</td>
<td>same as 1/2</td>
</tr>
</tbody>
</table>
Figure 3 – Priority for AWM Interventions
5.2 Suitability domains for selected AWM interventions at national level

Table 3 – Suitability domains for selected AWM interventions at national level

<table>
<thead>
<tr>
<th>Technology</th>
<th>Out-scaling Criteria</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In situ Seepage Systems – Wetlands, Dambo and Recession Systems</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. Zilili</td>
<td>At least 5 months of water table being below the root zone</td>
<td>Most of Barotse plain, Kafue flats, the banks of the kariba, and various other wetlands and dambos in the country</td>
</tr>
<tr>
<td><strong>In-Situ SWC/Conservation Agriculture</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. Conservation Farming</td>
<td>Availability of rainfall and need and possibility of holding on to rainwater to permit percolation</td>
<td>Conservation techniques such as mulching susceptible to cattle or fires</td>
</tr>
<tr>
<td><strong>Basic Water Application Models</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. Bucket</td>
<td>Surface water Ground water up to 30 m</td>
<td>May work across Zambia but often limited to shallow wells due to cost, or technology to construct wells to 30 m. Where such resources exist, the bucket may be surpassed by better technologies</td>
</tr>
<tr>
<td><strong>Solutions Incorporating Low Cost Water Lifting Devices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. Treadle pump</td>
<td>Surface</td>
<td>Most of the areas of Zambia—</td>
</tr>
<tr>
<td><strong>Motorized Water Lifting Pumps</strong></td>
<td>Ground water up to 8 metres</td>
<td>Market blue to yellow. Crocodile infested rivers will cancel use of surface water.</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>e.g. Motor Pump</td>
<td>Surface</td>
<td>Most of the areas of Zambia—market blue to yellow. Crocodile infested rivers will cancel use of surface water.</td>
</tr>
<tr>
<td></td>
<td>Ground water up to 8 metres</td>
<td>Most of the areas of Zambia—market blue to yellow. Crocodile infested rivers will cancel use of surface water.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Micro Irrigation Schemes Based On Small Dams</strong></th>
<th>Presence of Seasonal streams with engineering opportunity for damming</th>
<th>Mostly in Southern province of Zambia</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Nabuyani Irrigation scheme</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Agricultural Water Management Solutions Based On Diversion Weirs</strong></th>
<th>Presence of permanent stream and undulating land</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. River Damming/weir to lined canal Solution</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Solutions Based On Sophisticated Electric Water Pumping Systems</strong></th>
<th>Availability of electricity (hydro, motor driven electric motor, and solar)</th>
<th>Water table 30mts up to 60+m</th>
</tr>
</thead>
</table>