

TAMK UNIVERSITY OF APPLIED SCIENCES

Environmental Engineering

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PROVIDING INEXPENSIVE DRINKING WATER TREATMENT SOLUTIONS FOR  
DEVELOPING COUNTRIES – A CASE STUDY ON LUANDA, ANGOLA.

Supervisor                      Principle Lecturer, Marjukka Dyer

Commissioned by              Scan-Water (Former Plastec)

Tampere 2007

## ACKNOWLEDGEMENT

I am dedicating this project to the people of Angola and all people who suffered the same consequences all around the world and hope it will increase public awareness around the issue of water especially in the poorest regions of the world.

I thank Merja Karhu who dictated her time helping me find and specify my topic and gave me the task to do the research that I always dreamed doing and I thank Miikka Ristakari for giving me the contact for those who are the best to support my project.

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Ahmed Al-Ebrashy Providing inexpensive drinking water treatment solutions for developing countries - A case study on Luanda, Angola.

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## **ABSTRACT**

Even though Water represents 71% of the Earth's surface only 0,024% is provided to us as fresh water. The provided water is used in drinking, washing, industry, agriculture, adding water stress all over the world. The other problem concerning water is that human activities have contributed to the contamination of water through dumping wastes and other polluting activities. Besides, water is not distributed evenly around the world in a fair way therefore; the sparingly populated and water rich country such as Canada carries 20% of the World fresh water supply.

With the predicted continuous increase in population, the demand on water would double or even triple by 2050. In our case we present Africa is a continent that faces extreme water stress but uses only 4% of its fresh water supply. Therefore it provides an interesting target for a survey.

In this report I am going to focus on a rural area in an African country that was vulnerable during the civil war that lasted 27 years in the Central Highlands of Angola.

The survey was conducted by the WFP (World Food Programme) that took notes of the living standards, income, situations and measured and assessed the vulnerability level of the target area.

Even though prevention is better than cure in this theses the technical solutions are presented. These solutions are provided by Scan-Water Corporation (Former Plastec) and products are inexpensive compared to others, easy to transport, light weighted, and doesn't require electricity. The theses describe also the possibilities to those who could provide financial support and aid to these areas.

Tampereen Ammattikorkeakoulu  
Ympäristöinsinööriohjelma

Ahmed Al-Ebrashy Huokeita vedenpuhdistusmenetelmäratkaisuja  
kehitysmaille, kohdemaana Luanda, Angola.  
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## TIIVISTELMÄ

Vaikka vesi kattaa 71% maapallon pinta-alasta, ainoastaan 0,024% tästä on makeaa vettä. Tätä vettä käytetään juoma- ja pesuvedeksi sekä teollisuuden ja maatalouden tarpeisiin, mikä aiheuttaa maailmanlaajuisia painetta vesivarojen käytölle. Lisäksi ongelmallista vesivarojen kannalta on ihmisten toiminnallaan aiheuttama veden saastuminen; jätepäätösten laskeminen suoraan vesistöihin sekä muu saastuttava toiminta. Edelleen, vesivarat eivät ole jakautuneet tasapuolisesti maapallolla. Pinta-alaansa nähden harvimmalla asutettu ja samalla vesirikkain valtio Kanada saa osakseen 20% koko maapallon makean veden tarjonnasta.

Maapallon väestömäärän jatkuvan kasvun myötä makean veden tarve saattaa kaksin- jopa kolminkertaistua vuoteen 2050 mennessä. Tässä työssä keskitytään Afrikan mantereeseen, jolla on haasteenaan äärimmäinen vesipula. Afrikan väestö käyttää hyväkseen ainoastaan 4% käytettävissään olevasta makeasta vedestä. Raportti keskittyy keski-Angolan ylämaahan, joka on yhä haavoittuva valtio päättyneen 27 -vuotisen sisällissodan jälkeen. Raportti käsittelee WFP:n (World Food Programme) tutkimusta jossa kartoitettiin alueen asukkaiden elintasoja, tuloja ja elämäntilannetta tavoitteena määrittää alueen haavoittuvuuden taso. Vaikka ennaltaehkäisy on parempi kuin hoito, tässä työssä esitän teknisiä ratkaisuja alueen ongelmiin, joita tarjoaa Scan-Water Corporation (aiemmin Plastec). Näiden ratkaisujen erona muihin vastaaviin on edullinen hinta, kuljetuksen helppous, laitteiden keveys sekä se että ne eivät vaadi käyttövoimaksi sähköä. Valotan myös mahdollisia avustuskohteita niille tahoille, jotka voivat tarjota taloudellista tukea näille alueille.

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## 1. LIST OF ABBREVIATIONS

CSD	Commission on Sustainable Development of the UN 1997
FDI	Foreign Direct Investment
GEF	Global Environment Facility
GWISER	Global Geospatial Warning Information Surveillance Evaluation and Reporting
HIPC	Heavily Indebted Poor Countries
IDP	Internally Displaced Person
IPCC	Intergovernmental Panel on Climate Change
NGO	Non-Governmental Organizations
ODA	Overseas Development Assistance
PRRO	Protracted Relief and Recover Operation
UNICEF	United Nation's Children Fund
UNITA	National Union for the Total Independence of Angola
VAM	Vulnerability Analysis and Mapping unit
WFP	World Food Programme
WHO	World Health Organization
WSSD	World Summit on Sustainable Development

## 2. GLOSSARY

### **Cholera**

Diarrheal disease caused by bacterium *Vibrio Cholerae* which is transmitted by ingesting contaminate water or food.

### **Endemic**

When an infection is maintained in a population without the need of external inputs it is said to be endemic

### **IDPs**

Someone or group of people who were forced to leave their home place for religious or political persecution, war or natural disaster but have not crossed the international border

### **Nerox-02 Drinking Water Filter**

Nerox 02 Drinking Water Filter is an easy-to-use filter designed for personal use or for small groups. The filter removes all disease-causing bacteria. The concentration of heavy metals and pesticides can be reduced significantly. The filter works by gravity. It has no moving parts and needs no electricity.

### **Poverty**

Poverty has many definitions but it is typically defined as a person or group of people or community not having access to their very basic needs such as food, water, safe drinking water, shelter or social resources such as access to information, education, health care, social status and political power.

### **Rural areas**

Referred to country side and places settled away from the influence of large cities

### **Sanitation**

It is the hygienic means of preventing human contact from the hazards of waste to promote health it can be physical, biological, microbiological or chemical agents of diseases.

### **Scan-Water**

‘As of January 1, 2005, Plastec AS has restructured the company and established Scandinavian Water Technology AS, trading as Scan-Water, as a 100% owned subsidiary of Plastec AS. Included in this change are the following subsidiaries: Nerox Filter OY of Finland which will change its name to Scan-Water Finland, and Scan-Water South Africa, which will continue under the present name.’

### **Typhoid**

It is an illness caused by *Bacterium Salmonella* that can be transmitted by the ingestion of food or water contaminated with feces from an infected person.

### **UNITA soldiers**

An Angolan Political party that was originally anti-colonial which became a rebel forces after Angola’s independence in 1975.

### 3. INTRODUCTION

There are many definitions for poverty that will be addressed later. However there are many poor people in this world. With the poverty definition of \$1 per day there were 1,175 million poor, and 2,811 million people live on less than \$2 per day. That means 56,1% of the world population is considered to be below the poverty line.

There are many common patterns when it comes to poverty in any country, and it goes to the extreme especially in Sub-Saharan Africa. Before addressing some of the poverty facts in Sub-Saharan Africa we will talk about some of the facts that are common. There are more than 1,1 billion people who lack access to improved water supply and 2,4 million people who lack adequate sanitation, and since life is unfair, 84% of those lacking water supply and 83% of the people who lack sanitation live in rural areas – and 1,7 billion live in countries that are water stressed. Another interesting pattern that appears in most poor regions and still emphasizing on rural areas, is that the water is usually very endemic which can result in many fatal diseases such as cholera and typhoid. There are 4 billion cases of severe diarrhea (cholera) each year causing 2,2 million deaths - mostly children. A follow up graph of cholera cases in the Central highlands of Angola is illustrated in Figure 2. According to the Intergovernmental Panel on Climate Change (IPCC) *‘Those with the least resources have the least capacity to adopt and are the most vulnerable’*. Also 800 million people do not have their basic energy needs and there are 2 billion who lack a balanced diet. An important realization to consider is that poverty in Sub-Saharan Africa is more extreme or we can say more critical than in other areas around the world. Sub-Saharan Africa has the highest proportion of people without water and 70% of the available water supply will go to the agricultural sector, which is usually the main source of income for poor areas. Due to lack of water supply, the last generation had a decline in the food production per capita and several millions are still malnourished. That is also important to state that 93% of the total Sub-Saharan African population lives on less than \$1/day.

We can conclude from these facts that all the poverty factors and patterns such as water shortage, poor water quality, endemic diseases, lack of balanced diet, etc., are

present in the Central Highland of Angola which is our main focus point in this report. /3/,/4/,/9/

### 3.1 FRESH WATER IN AFRICA

Africa is one of the 2 regions in the World that is facing serious water shortages and is using only 4% of its renewable fresh water resources. Even though Africa is abundant in its fresh water resources especially in the humid Western and Central Africa where there are supplies off fresh water due to its rainfalls even though they can be unpredictable sometimes. The problem of water in Africa is sometimes due to its uneven distribution or other contributing factors such as 'Inadequate assessment and underdevelopment of water resources, the lack of technical institutional infrastructure as well as the lack of investment in water resources development'.

Since 1950 Africa's share of water per capita has declined for about 50% and that is due to the continuous increase in demand for water due to population growth and economic development and that maybe leading to growing concerns when it comes to water resources and access to water especially that 50 rivers of Africa are shared by countries which may even enter to war or other conflict.

Africa is an agricultural continent with agriculture consuming 88% of total water use.

'The main threats to water quality in Africa include eutrophication, pollution and the proliferation of invasive plants such as the water hyacinth (*Eichhornia Crassipes*) and (*Salvla Moltesta*) weeds.

An ethical question arises from the topic since it is a phenomena that is spread all around Africa and also in our case study Angolan Central Highlands. In draughts and chronic water shortage areas the most vulnerable people are women and children who usually have to pay the highest price with the increased in demand for water and shortage of supplies. Some of the children - especially girls - as seen in our case study have to give up school, or increase level of absence from school, to carry water for very long distances. In addition to that, they spend more calories carrying the water for long distances and suffer more in impaired health from contaminated or insufficient water and lose more in diminished livelihood and even

lost lives. More than 300 million people in Africa lack access to safe water accounting for 51% having access to safe water and 45% to sanitation. Another distinct is that urban areas generally have better access to safe water and sanitation than those living in rural areas. /3/,/5/

## 4. WATER DISEASES CHOLERA

Cholera is a diarrhea disease caused by the bacterium *Vibro Cholerae* and it is transmitted to humans when ingesting contaminated water or food. /8/

### 4.1 TRANSMITION

The person infected by Cholera will have massive diarrhea and the bacteria loaded feaces can be spread into the infected water. The untreated water will get into the waterways or into the ground water or drinking water supply. The next victim will be the person drinking the untreated water causing infection. /8/

### 4.2 PREVENTIONS

The life threatening disease can be prevented fairly easily with the proper sanitation and practices.

- Sickbeds: Proper disposal and treatment of germ infected fecal waste (Dry toilets can achieve that).
- Sewage: Treatment of general sewage before it enters the gate ways.
- Sources: Warning about the spread cholera and how to be decontaminated.
- Sterilization: Boiling, filtering and chlorinating water will kill the bacteria produced by the cholera patients and prevents infections./8/

### 4.3 CASE STUDY: GETTING LIFE SAVING WATER TO PEOPLE THREATENED BY CHOLERA

February 2006 reported the worse cholera outbreak in Angola with 500-700 reported new cases reported daily in Luanda.

The cholera epidemic was a result of shortage of clean water and poor water sanitation over the crowded area where the epidemic spreads quickly to other parts of the country.

The intervening of UNICEF (Pic.1), WHO and other key partners have contributed to and supported the government by providing and distributing clean drinking water, chlorine to sanitize the water supplies, emergency medical supplies and social mobilization material.

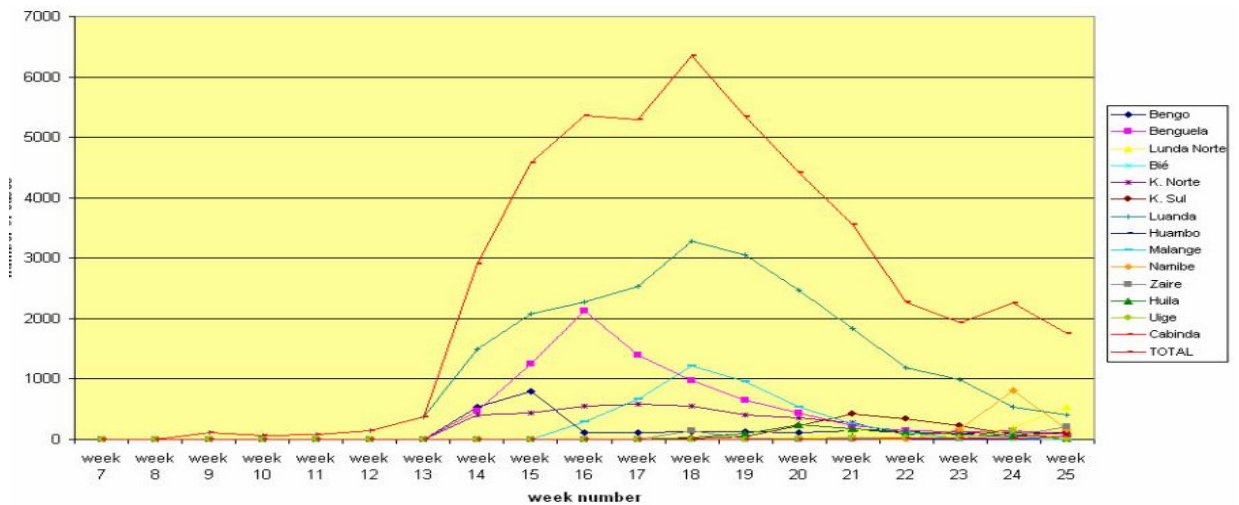
Although that contribution was successful and had decreased the number of cholera diseases and death, the disease is persistent and spreads all over the country. 39,685 people got sick while 1,486 were killed in 13 of Angola's 18 provinces. There are over 300 cases everyday and 35% are under the age of 5. /6/



**Picture.1 Safe drinking water, supplied by UNICEF to population in the area highly affected by cholera /6/**

#### 4.3.1 CHOLERA OUTBREAK IN ANGOLA

A WHO report dated June 2006, total 4675 cholera cases had been reported including 1893 cases that lead to death. Out of 18 provinces 14 had an outbreak, with the highest percentage occurring in Luanda where almost 50% of the population were affected, and 17% in Benguela province. There have been cholera cases in nearly all the provinces of the Central Highlands with the largest outbreak in Benguela. (Fig.1) illustrates the number of cholera outbreaks in all Angola provinces including the total number of cases. The good news is that the trend has been dramatically decreasing as a result of an increase in the water sanitation and quality. /9/

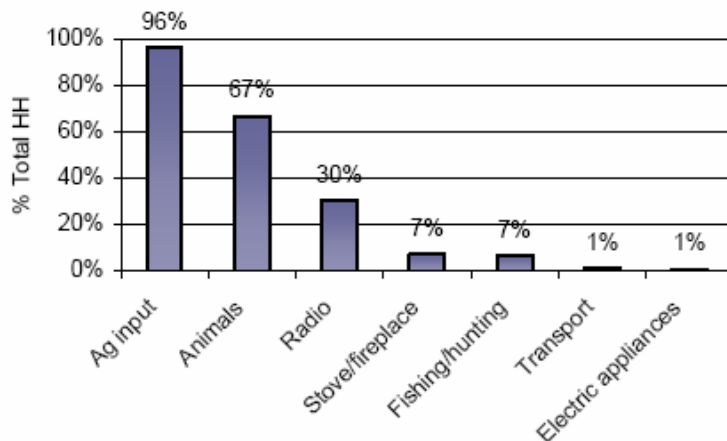


**Figure.1: Number of cholera Outbreaks over a 25 week period in different regions of Angola/9/**

## 5. HOW WATER QUALITY AND POVERTY ARE DIRECTLY LINKED:

By analyzing the Table of Millennium development (Table.1) we can conclude how water quality can have a direct impact on sustainable development and poverty rate. In Angola there have been major disease outbreaks such as HIV, Malaria and Cholera, which have spread all around Angola. Improving water quality and management will reduce mosquito habitats and the occurrence of cholera, and it would improve health and living conditions, whereby reducing susceptibility to HIV and other diseases. Further, improving water quality would reduce the burden of carrying water from long distances and would improve health resulting in an increase of school attendance especially for girls. A United Nation Survey shows that girls have to travel several kilometers to get water which leads to absence from school. Water quality has definitely a direct link with agriculture, food production and solving hunger problems which are major issues in the Central Highlands, since a large percentage of their assets and sources of income are based on fishing, agriculture and livestock (Fig 2 and Fig 7). Agriculture consumes 70-80% of the water used, and the water quality can expand the crop quality, grain production and health of the livestock and fish. As a result hunger would decrease as food grains become cheaper from more reliable water supplies. /4/,/5/





**Figure.2: Household asset ownership by type /5/**

## 6. UNDERSTANDING POVERTY AND WATER SECURITY

Previously the only definition for poverty was not having enough cash or income. However, the new understanding of poverty is complex and multidimensional, involving material and non-material conditions of life. *'Lack of education or human rights is as much part of the poverty experience as not having enough to eat or inadequate shelter'*. There are many factors that accompany poverty, which are present in the report conducted by the WFP for the Central Highlands of Angola - and probably the same applies to all regions of Angola - as these factors are present in a random order in any poor area worldwide, with extremes in the developing countries. /4/

### 6.1 GOOD GOVERNANCE

Corruption is usually one of the major signs that leads to poverty. Corruption usually involves a discreet government instead of transparent government agencies. Another distinction is that poor people don't usually participate in decision-making and therefore the system is threatening their security and political freedom. Therefore, new decisions need to be granted to make the people participate in the society so they wouldn't be voiceless under the political decisions that affect their lives, as has been seen during the 27 years of civil war, which has affected the water management, the design and operation of water supply schemes. /4/

## 6.2 GENDER

Women are usually regarded inferior in the rural areas or in poor countries in general that makes them very vulnerable to risks. They are usually poor and powerless that makes it more difficult for them to escape the poverty trap than men. 'Poverty reduction strategies need to create more balanced gender relationships. In no aspect of life this truer than for water; *Women are the managers of domestic water and of family health...biases persist, despite all the rhetoric on the importance of women*'. (Vision 21:8) /4/

## 6.3 VULNERABILITY

Another key distinction is that poor people are very vulnerable to factors that can lead to physical harm and disrupts their livelihood. These can be categorized into:

- **Shocks;** Natural disasters, wars, collapsing market prices
- **Fluctuation;** Changes on rainfall pattern, employment opportunities.
- **Trends;** Gradual environmental degradation, oppressive political system, or deterioration terms of trade.

As our report will reveal that all the vulnerability factors are present in Angola, especially in the Central Highlands where are the most rural and vulnerable areas. /4/

## 6.4 LIVELIHOOD

Assets owned are tools to move out of poverty. Increasing or improving the assets owned by the poor could increase their standards of living. Water resources are considered to be an asset, but not water by its own, but other flows created by water such as hydropower or fish. Other assets of livelihood include:

- **Material assets:** Access to land, other natural resources, financial capital and credit
- **Human Capabilities:** Family knowledge and skills.
- **Social and political factors:** Contact networks and openness of government intuition.

Strengthening assets would be making up the livelihood of the poor thus decreasing the poverty patterns./4/

## 6.5 ENVIRONMENT

Poor people are usually very dependent on their access to natural resources and therefore can be an obstacle to sustainable development. They also have less control in their resources and as a result, environmental conditions are degraded with such results as pollution and decreased water quality. /4/

## 6.6 ECONOMIC GROWTH

Economic growth is a key issue to increasing or decreasing poverty patterns. However, when dealing with economic growth the corruption factor needs to be taken into account; *'In poverty reduction, both the size of the pie and how it is divided matter'*. The quality of growth should be targeted to the poor and be under their control. The wise use of water resources and effective investments in water management can have a catalytic effect that resonates throughout the wider economy of regions and nations. /4/

## 6.7 WATER SECURITY

There are direct links between poverty reduction and water security. As observed from the following table (Tab.1), improving water management, sanitation and quality has an impact on almost all poverty patterns such as hunger, primary education, gender equality, child mortality, maternal mortality, major diseases and environmental sustainability. The table also illustrates the Millennium Development Goals that were set during the World Summit on Sustainable Development (WSSD) in Johannesburg in August-September 2002 to promote sustainable development and poverty reduction. *'Eradicating poverty is the greatest global challenges facing the world today and an indispensable requirement for sustainable development, particularly for developing countries'* (WSSD plan of Implementation. 2002:1) /4/

Millennium Goal	Direct Contribution	Indirect Contribution
<p><b>Poverty:</b> to halve, by 2015, the proportion of the world's people whose income is less than \$1/day</p>	<ol style="list-style-type: none"> <li>1) Water as a factor of production in homestead gardening, agriculture, industry, and in many other types of economic activity</li> <li>2) Investments in water infrastructure and services as a catalyst for local and regional development</li> </ol>	<ol style="list-style-type: none"> <li>1) Reduced vulnerability to water-related hazards boosts investments, production, and development</li> <li>2) Reduced ecosystems degradation boosts sustainable development at the local level</li> <li>3) Improved health from better quality water increases productive capacities</li> </ol>
<p><b>Hunger:</b> to halve, by 2015, the proportion of the world's people who suffer from hunger</p>	<ol style="list-style-type: none"> <li>1) Water as a direct input irrigation for expanded grain production</li> <li>2) Reliable water for subsistence agriculture, home gardens, livestock, tree crops, etc</li> <li>3) Sustainable production of fish, tree crops, and other foods gathered in common property resources</li> </ol>	<ol style="list-style-type: none"> <li>1) Ensured ecosystems integrity to maintain water flows to food production</li> <li>2) Reduced urban hunger by cheaper food grains from more reliable water supplies</li> </ol>
<p><b>Universal Primary Education:</b> to ensure that by 2015, children everywhere will be able to complete a full course of primary schooling</p>		<ol style="list-style-type: none"> <li>1) Improved school attendance from improved health and reduced water-carrying burdens, especially for girls</li> </ol>
<p><b>Gender Equality:</b> progress toward gender equality and the empowerment of women should be demonstrated by ensuring that girls and boys have equal access to primary and secondary education</p>		<ol style="list-style-type: none"> <li>1) Having women in community-based organization for water management improves women's social capital</li> <li>2) Reduced time and health burdens from improved water services lead to more time for income earning and saving activities and more balanced gender roles</li> </ol>

<p><b>Child Mortality.</b> To reduce by three fourths, between 1990 and 2015, the rate of child mortality</p>	<p>1) Improved quantities and quality of drinking and domestic water and sanitation reduce main morbidity and mortality factor for young children</p>	<p>Improved nutrition and food security reduces susceptibility to diseases</p>
<p><b>Maternal Mortality:</b> to reduce by three fourths, between 1990 and 2015, the rate of maternal mortality</p>	<p>1) Improved cleanliness, health, and reduced labor burdens from water portage 2) Reduced mortality risks</p>	<p>Improved health and nutrient reduces susceptibility to anemia and other conditions that affect maternal mortality</p>
<p><b>Major Diseases:</b> to halt and begin to reverse, by 2015, the spread of HIV/AIDS, the scourge of malaria, and the scourge of other major diseases that affect humanity</p>	<p>1) Better water management reduces mosquito habitats and malaria incidence 2) Reduced incidence of a range of diseases where poor water management is a factor</p>	<p>1) Improved health and nutrient reduces susceptibility to HIV/AIDS and other major diseases</p>
<p><b>Environmental Sustainability:</b> to stop the unsustainable exploitation of natural resources and to halve, by 2015, the proportion of people who are unable to reach or to afford safe drinking water</p>	<p>1) Improved water management, including pollution control and sustainable levels of abstraction-key factors in maintaining ecosystems integrity 2) Actions to ensure access to adequate and safe water to poor and poorly serviced communities</p>	<p>1) Development of integrated management within river basin creates conditions where sustainable ecosystems management is possible and upstream downstream impacts are mitigated</p>

Table 1: Water, poverty, and the Millennium Development Goals.

## 7. SIMPLE WATER TREATMENT SYSTEMS

There are more than one solutions that are simple and effective to be used in rural areas that suffer water problems however later we will focus on Scan-Water solutions.

### 7.1 Using UV light, Horseradish and Slimes to purify water:

A UV light (Figure.4) device has been invented to kill disease causing organisms in drinking water. The device was invented by a physicist at California's Lawrence Berkeley National Laboratory named Ashok J.Gadgil and it can disinfect 57 liters (15 gallons) of water per minute at a very low cost. The device consumes only 40 watts of power supplied by the solar cells and it is best applied in remote areas of developing countries.

In addition, a handheld device weights 7 kilograms, consumes only 40 watts of power supplied by solar cells which is quite a good source in a sunny land like Angola. The AA batteries use ultraviolet light to kill about 99.99% of the bacteria and the viruses found in the water.

The device can be applied in the possible scenarios;

- (1) People travelling abroad.
- (2) Campers and backpackers.
- (3) Home owners when storm or other disasters shut down their water supply systems. (2), /12/



**Picture.2 Ashok Gadgil's UV water disinfection system is manufactured by Water Health International. The simple machine can clean enough water every day for 1,000 people.**

## 7.2 LESSONS FROM BANGLADESH

In Bangladesh, households receive strips of clothing that filters cholera-producing bacteria from drinking water, which has cut the number of cholera cases to half in the villages that have used it.

Proctor and Camble is a company that has developed a ketchup size sachet that can purify up to 10 liters of water. Each packet costs around 10 cents and contains microbe killing calcium hypochlorite and iron sulfate that sops up suspended matter. The company and the international aid agencies have distributed about 50 million of these packets to rural areas in developing countries. /1/

## 7.3 DRINKING WATER QUALITY

Water treatment plants and water shed protection can be practical and provide safe drinking water for dwellers in developed countries. However, that might not be easy to achieve in developing countries; therefore cheaper and simpler ways had to be developed to purify and provide safe drinking water for individuals and villages in developing countries.

One of the very simple ways of drinking water treatment was to expose a clear plastic bottle filled with contaminated water to sun light. The heat and sun UV rays can kill infectious microbes in little as in 3 hours. Painting one side of the bottle black can improve the absorption in the simple solar disinfection method that applies one of the 4 sustainability principles. When this method has been used diarrhea has decreased by 30-40%. This was invented by the WHO (World Health Organization). /1/

## 8 CASE STUDY: ANGOLA (CENTRAL HIGHLANDS)

Angola is an African country located in South-Central Africa bordering Namibia to the south, Democratic Republic of Congo to the north and Namibia to the east, and with a west coast along the Atlantic Ocean (Pic.3). Its Capital is Luanda and its economical natural resources are oil and diamonds. Population is 1,212,7000 people recorded in 2006.

Angola was a Portuguese Colony in 1575 and regained their independence in November 1975. (1)



Picture.3 Map of Angola

## 9 ECONOMY OF ANGOLA

After Angola gained its independence, the economy severely collapsed due to a civil war, the main negative factors being nationalization of large enterprises, ineffective central planning, overvalued currency and the constant exodus of skilled personnel. The suffering of economy and bad conditions were a result of dramatic events such as the collapse of the coffee industry: Coffee was a major export item in Angola, making the country the fourth major exporter of coffee. The workers suffered a dramatic fall in living standards and they were prevented from joining trade unions.

To make matters worse, in 1980s the country suffered famine although it had been a net exporter of food before the independence. /3/

## 10 SUMMARY OF THE WFP REPORT

A report and study conducted 2 years ago by the WFP for a Protracted Relief and Recover Operation (PRRO) started in 2004 and December 2005. The study and operation has been assisting the 2,5 million refugees and returnees that have been repatriated and resettled into communities to put up their dwellings and prepare the land for planting. The study took place in the Central Highlands of Angola. These are the most vulnerable and food insecure areas in the country since most of the fighting during the war took place in these areas.



The area hosts the most of displaced or recently retired populations including the majority of the former UNITA soldiers. It suffers lots of environmental degradation due to over cropping and deforestation and a very poor road network which impedes agricultural development.

We can use that study taken by the WFP to undertake a detailed food security and livelihood survey about this part of the country. Since Scan-Water focuses mainly on rural and tragic areas the statistic can give general information about the application of their products.

The main objectives of the survey taken by the WFP Program (PRRO 2006-2208) in the most vulnerable area of the country after the return of peace and stability were to:

- Asses the overall socio-economic situation of resident populations and returnees and their level of food security.
- Asses people's livelihood objectives.
- Provide recommendation on whether there is a need for food and beyond 2005 and if yes where in which sectors.

From the author's point of view and experience the areas with food problems suffers from water problems as well /5/

## 11 METHODOLOGY

The survey covered 160 rural areas and it included household and community questionnaire and anthropometric measurements of children under 5. The survey included 160 rural communities (1,921 households) in seven agro-economic zones which includes entire province of Huambo, western parts of Bie Province (33% of province), Northern Huila (14%), Eastern Benguela (12%) and southern Kuanza Sul (8%). There were 3 types of questionnaires:

a) Household questionnaire: Household demography

-Housing conditions

-Assets

-Income sources and expenditures

-Food consumption

- Food sufficiency
- Risks
- Shocks and coping strategies
- Child health and nutrient

b) Community survey questionnaire (collect information at community level)

- Access to school
- Health and market infrastructures
- External interventions
- Qualitative focus groups discussion on specific topics such as education, health, food intake and external aid. /5/

## 11.1 TOOLS FOR THE SURVEY

In that section we will be addressing the tools used to gather quantitative and qualitative data and the instruments used could be divided into 3 categories:

### 11.1.1 HOUSEHOLD QUESTIONNAIRE

These are questionnaire that are related to household situation such as the income and expenditures, assets ownership, education, demographics, livelihoods, weekly food consumption, risks, shocks and coping strategies.

### 11.1.2 NUTRITION QUESTIONNAIRE

This questionnaire includes hygienic issues such as health and sanitation of children under 5 years old, including anthropometric measurements.

### 11.1.3 COMMUNITY SURVEY

The survey is carried to 5-6 key people within the community by asking questions regarding the social infrastructure in the community, demographics and socio-economic and population movements, access to health and education services, external intervention and coping strategies.

The household and community survey was followed by the focus group discussion on the subjects of:

- Livelihood (men and women)
- Education (women only)
- Health and food intake (women only)
- External and solidarity (women only)

## 11.2 FIELD DATA COLLECTION AND ENTRY

The data collection took place between November 2004 and January 2005 and it was collected by 9 teams. The team enumerators were NGO's working in the area and government institutions who attended a 5-day training session on the objectives of and methods of the survey.

To ensure that the data was free of errors, inconsistencies and miscoding, the data entry was carried out by 3 clerks. After the analysis of field data the group discussion took place in a ten day period in April 2005. /5/

## 11.3 DATA ANALYSIS

In the framework of World Vision's Global Geospatial Warning Information Surveillance Evaluation and Reporting (GWISER) initiative, the WFP and World Vision collaborated with the staff of Tulane University and assisted them in analyzing the quantitative data.

The qualitative data was analyzed using a risk and livelihood analytical framework developed by the Vulnerability Analysis and Mapping unit (VAM) in WFP Rome. VAM staff in Luanda compiled the report. /5/

## 11.4 ANALYTICAL FRAMEWORK

Several analytical approaches were applied. The method used was the triangulation of results and that lead to:

#### 11.4.1 DEFINING SOURCES OF VULNERABILITY

- Keys to vulnerable groups and their living conditions, risks they face and the incidence of these risks
- Key risks and shocks
- Formal and informal coping mechanism of households and communities /5/

#### 11.4.2 UNDERSTANDING BETTER THE MULTIDIMENSIONAL NATURE OF VULNERABILITY

This is to do with non-material wealth such as vulnerability due to poor education standards, poor nutrition and health, lack of basic services, poor housing and lack of access to remunerative employment. /5/

#### 11.4.3 DOCUMENTING THE CORRELATION BETWEEN HOUSEHOLD CHARACTERISTICS AND VULNERABILITY

This study simply states the people are likely to be food insecure and the factors and conditions that lead them to that. The analysis is limited to a particular dimension of welfare consumption. /5/

The analytical approaches towards the triangulation were

- Household clustering according to seven parameters
  - ❖ Displacement : Percentage of people being displaced;
  - ❖ Livelihoods: 2 main economic activities of households;
  - ❖ Productive Assets: Percentage of households having agricultural assets;
  - ❖ Income diversity: Mean number of income sources outside main livelihoods (agriculture);
  - ❖ Diet: Frequency and diversity of diet based on FANTA groups;
  - ❖ Risk exposure: Mean number of risks that households are exposed to
  - ❖ Aid: Percentage of households receiving aids including diet.
- Household long and short term income analysis (Wealth Analysis)

- Short and long term analysis of household economics where short term analysis based on their ability to meet day to day requirements (Own production, purchasing, aid) while long term is based on assets owned (Wealth Index)
- Focus group discussions provided valuable information on the risk and livelihood contact within each parameter, explaining the story behind numbers'. /5/

## 12. ANALYSIS AND REPORTING KEY FINDINGS

Collaboration between WFP and World Vision USA, New Orleans:

The results were rather poor. It seems that vulnerability in Planalto is dominated by the effects of the civil war, the returned refugees have very few assets and there are very few income generating activities as seen in (Tab.2) below.

	Planalto	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
<b>New returnee &lt;3 years)</b>	35%	20%	48%	27%	47%	38%	35%	25%
<b>Displaced</b>	67.4	61.1	73.1	61	87	62.7	57.5	71.9
<b>Female HH</b>	36%	34%	31%	45%	34%	27%	42%	46%
<b>Wealth Index</b>	0	0.14	0.72	-0.26	0.03	-0.59	0.07	-0.33
	-	4	2	5	1	7	6	3
<b>Stunting (&lt;-2 Z)</b>	45%	50%	42%	46%	38%	36%	55%	51%
<b>Wasting (&lt;-2 Z)</b>	13%	11%	10%	8%	27%	9%	21%	7%
<b>Eating &lt;=1 meal/day</b>	16%	16%	24%	16%	8%	20%	6%	27%
<b>Oxen for animal traction</b>	6%	3%	10%	0%	20%	2%	4%	0%
<b>Households food insecure</b>	18%	23%	28%	15%	14%	17%	12%	15%
<b>Food aid recieved</b>	44%	32%	37%	41%	48%	53%	58%	38%

**Table.2: Key parameters linked to the vulnerability and food insecurity by**

**zone /5/**

Demography:

Women head 36% of the households in the Planalto and they are wealthier than the ones headed by the males. Elder people head 5% and children run 2%. Like many developing countries households can suffer from overcrowding especially in small rooms. 22% of the population has six or more in 1 room and on average the Planalto household is 5.

#### Displacement and resettlement:

Over 67% members of households have been displaced at least once during life time.

#### Literacy:

Like in most of the developing and rural areas the majority of the population is illiterate. The population has 40% literacy, and 73% have never finished primary education. 115% of the children enroll in the primary school while only 5% enroll in secondary education.

#### Livelihood and income sources:

Agriculture is the main practice by 94% of the rural population and most of these households raise livestock. 22% of the rural population raises other animals than poultry. Unfortunately for 60% of the population their only source of income comes from supplement agriculture.

Potatoes, beans and vegetables generate the highest income revenues. The rest of the income is earned from paid work which favors men over women. Besides, permanent work is available to only 7% of the households.

#### Expenditures:

About 80% of the total household expenditure is for food which is a typical characteristic of poverty. It was also noted that the food aid expenditure has been very successful and the poorest areas spend the smallest percentage in food due to food aid.

#### Nutrition:

Wasting rates are very high. Possible factors include the high diarrhea rates occurred 2 months prior to the survey. The research took place during the worst period of the year for gastro illness (November to January). The prevalence of acute malnutrition is very sensitive to seasonal changes.

Energy and water sources:

In the survey it is concluded that 93% of the households use firewood for cooking, which contributes to the environment degradation in the densely populated areas.

Rivers are the main source of drinking water for half of the households, and almost all households live within the range of 30 minutes walk to water source.

Assets and livestock:

90% of households possess agricultural inputs and while only 22% of households own livestock excluding poultry, large livestock is owned by only 5% of the households and 4% have oxen for agricultural production.

Diet:

Most commonly eaten food are;

- Cereals = 87% of households
- Tubers = 76% of households
- Pulses = 55% of households

However in some areas up 27% of households take only 1 meal per day.

Risks:

*Household hazards affecting productive activities*

- Lack of seeds
- Lack of crop infestation
- Death of animals

*Coping*

- Dietary adjustments
- Seeking aid
- Seeking employment/Commerce and small portion copes by taking children out of school marrying daughters early. 75% of high risk household receives aid.

Aid:

Food aid is the most common form of aid and approximately 44% of the households surveyed receive the aid. The aided is divided into the following categories;

- Agricultural aid = 34%
- Non-food assistance = 18%
- Money = 5%
- Food aid = 73%

Wealth index:

Areas with the lowest wealth index are the most vulnerable in that they have relatively less assets, and will face more difficulties to overcome emergency situations.

Households led by women have the highest wealth index and they are wealthier to provide with a livelihood guarantee, while households led by young people seem to face more challenging situations as they have a low wealth index and therefore higher exposure to risks./5/

## 11 SUMMARY AND ANALYSIS OF SPATIAL DISTRIBUTION OF VULNERABILITY

From (Tab.3) we can conclude that there are at least 3 zones with serious water issues where the population has to rely on untreated water sources. To make matters worse, all zones are deficient in terms of transportation. That means that water analysis, purification and transportation are a real issue in those areas. Two zones that suffer access to water also suffer a crowded household (zones 1 and 7). Zone 7 is least benefited by the aid programmes while zone 4 receives the least of food aid.

<b>Variables</b>	<b>Geographic Risks</b>
<b>Crowded Households</b>	Zones 1, 3,5 and 7
<b>Female headed</b>	Zones 3,4 and 7
<b>Migration</b>	Highest percentage of migration in Zones 3, 6 and 7. Zones 4 and 6 have the highest percentage of households with less than two harvest and Zone 4 has the greatest net flow of departures
<b>Activates</b>	Seasonal activities like agricultural and occasional jobs are more significant in Zones 4 and 6. This last zone has the greatest diversity of household engagement in activities
<b>Scarcity of modern</b>	Zones 3, 5 and 7 are deficient in terms of



<b>agricultural inputs</b>	agricultural inputs. The last two zones also complain about the precarious job market
<b>Roads and transportation</b>	Basically all the zones are deficient in terms of roads and transportations
<b>Access to water</b>	Zones 1, 6 and 7 are the most problematic in terms of water supply and relying on a precarious source of drinkable water
<b>Education</b>	Zones 3 and 6 are deficient in terms of primary schooling and present the smallest percentage of enrolment
<b>Health</b>	Zones 3, 5 and 7 are relatively in terms of availability of physical infrastructure and qualified professionals
<b>Market</b>	Zones 3, 5 and 7 are relatively less covered by markets
<b>Aid program</b>	Zones 3 and 7 are relatively less benefited by aid projects
<b>Food aid</b>	The smallest number of people receiving food aid is in Zone 4. Zones 1, 2 and 6 benefited the most
<b>Environmental degradation</b>	Zones 1 and 2 are the most deforested

**Table 3 Synthesis of the most vulnerable areas in the Central Planalto (5)**

## 14 SURVEY

In the next section we will study the survey conducted during the study of WFP for a Protracted Relief and Recover Operation (PRRO) in more details. The section includes background, objectives, and methods of analysis and data collection. We are interested in life of the people in this slum area in Angola as an area that suffers the most. /5/

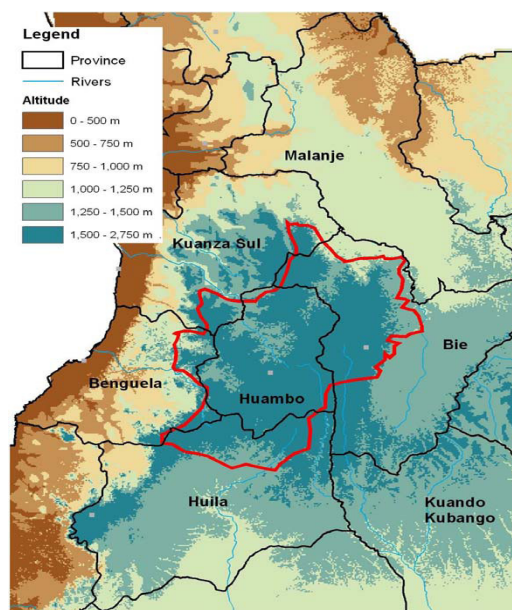
## 15 BACKGROUND OF THE SURVEY

A 27 years old war has ended with the death of just one number; the leader of UNITA. A selfish ambition can destroy the lives of thousands of people; one person can cause dramatic effects. The Hay Vulnerability Assessment showed that the Central Highlands (Pic.4) of Angola are the most vulnerable and suffers the highest levels of poverty and food insecurity and these are many effects that have resulted from the poor life standards. The Central Highlands covers a 79,040 km<sup>2</sup> of the total

area of the country and 57% of this area are inhabited by 2,3 million people that suffers the following consequences;

- The majority if not all suffers poverty, and few productive or domestic assets at households level.
- The area is very sensitive to risks and people will have to give up their assets to cope in the stressful situation.
- There are very few income generating activities that are mainly from agricultural and livestock.
- Localized high population density, resulting in limited access to agriculture land.
- Impoverished soils, poor farming practices with few agricultural inputs.
- High pressure of natural resources:
- Livelihood of the rural population exposed to various social, productive and economics risks.

However, the cooperation programmes between world wide organizations and NGO's such as WFP/VAM, Ministry of Agriculture and Ministry of Health, UNICEF etc. have included collection of information and statistics, provision of aid and resulted in some improvements in the living standards. /5/



Picture.4 Overview of the Central highlands /5/

## 15.1 OBJECTIVES OF THE SURVEY

The objective of the survey was to understand the detailed food security in the Central Highlands of Angola and the livelihood of the population thus to better understand chronic levels of vulnerability.

### 15.1.1 OBJECTIVES INCLUDE

- To determine and define the hungry, poor and vulnerable population.
- To understand the cause of vulnerability and food insecurity.
- To determine the risk exposure of different household groups and the risk management and livelihood strategies of communities and household.
- To identify areas of intervention where food aid may have an advantage in addressing food insecurity and vulnerability.
- To provide a basis for development and improvement of existing food security monitoring systems.

### 15.1.2 ULTIMATE GOALS

- Guide the formulation of food and non-food based safety net programmes and decision- making that would lead to improved household livelihood and food security.
- Outlines community food security strategies that already exist and that can be reinforced through appropriate programs
- Design food-aid programs that complement and strengthens community structures than compete with them. /5/

### 15.1.3 OBJECTIVES OF MY REPORT

The objective of my report is to collect the survey data and analysis of the livelihood of the people in the Central Highlands. The data should include the number of people living their main challenges so that we can provide a conclusion if Scan-Water products and other technical solutions that can be effective in these areas, which are the most appropriate products and how can they be financed.

## 16. BACKGROUND OF THE CENTRAL HIGHLANDS

The Central Highlands is characterized by its important agricultural and commercial activities such as maize cultivation intercropped with beans, cassava, and sweet potatoes. These activities were feeding one third of the rural population of Angola. The highlands are located at high altitudes ranging between 1000 and 2500 m above the sea level. Before the independence in 1975 the Central Highlands' rural population was living in good conditions, even though the agricultural inputs were limited and the soil quality was poor. They counted on livestock for transportation and traction, and a good commercial network provided the population with good living conditions.

However, as known throughout the history, in a suitable political climate, the selfish need for power can lead to drastic events. A civil war started and kept going for 27 years, ending by the death of a single person, the leader of UNITA. The results were devastating: the road network was degraded and the farmers were displaced. Today, 95% of the households are subsisting farmers with a limited access to agricultural inputs and low technology equipments. The effect of the war has forced most of the population to settle in a small area and has resulted in accelerated degradation of vegetation and soil. Due to the increase in population pressure, deforestation has increased. /5/

## 17. HISTORY OF THE DISPLACED PEOPLE IN THE CENTRAL HIGHLANDS

Urbanization is linked to economic development, which was the case in Angola before the independence. However, a civil war emerged following with political instability and between years 1991-1992 - which was a peaceful period - the number of internally displaced persons was 800 000 with only a small number of people returning home. The unsuccessful electoral that was processed in September/October 1998 lead to the resumption of fighting which increased the number of displaced people to an additional 2 million.

During the second half of 1998 a full-scale war erupted between the government and UNITA troops. As a consequence, mainly villagers and farmers from the North, East and Central highlands fled from the countryside to the city due to the increase in attacks and ambushes, as estimated by the OCHA between 1998 and February 2002. The continuous shift of population from rural areas to urban areas lead to losing ties with members of family and home communities. The population is now concentrated in the major urban areas of the country, where around 60% of the population lives.

Anyhow, 2 years after the Luena peace agreement the government reported that 2,34 million IDPs had returned home (area of their origin) mainly to the provinces of Huambo, Bengula, Icuanza Sul and Bie. Half of the refugees that fled to neighboring countries, about 225 000 persons, have returned home since the end of hostilities. /5/

## 18. ADDRESSING CONDITIONS IN THE CENTRAL HIGHLANDS

After the brief history introduction concerning the conditions in the area there are lots of statistics that can be very useful when addressing the challenges that are facing these areas. We need all information possible on order to conclude how we can support the project.

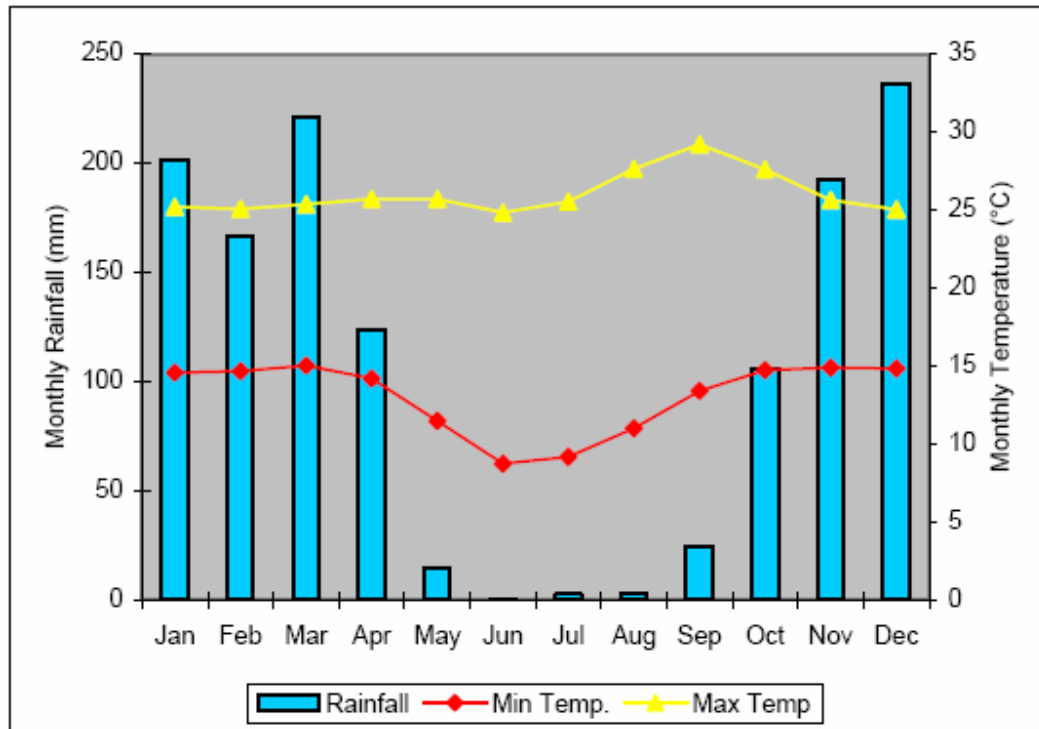
### 18.1 ENVIRONMENTAL CONDITIONS

The environmental issues of the country are addressed below, divided into two conditions: climate and soil. This will give us an idea about water issues in the Central Highland. Although they are not directly related they will give some indication of the usable water supply. /5/

#### 18.1.1 CLIMATE

There are mainly two seasons in the Central Highlands Platue area (Fig.3). The first is a cool dry season and the other is a hot rainy season which lasts for 7 months, starting from September to the end of April. During this season rainfalls can vary

between 1 000 and 1 500 mm, December being the wettest month. This makes the Central Highlands’ climate very favorable, rain becoming increasingly the main source of water, similarly to Namibia and Botswana.



**Figure.3 Illustrates average monthly rainfall and temperature in the Central Highlands (5)**

### 18.1.2 SOILS

We are interested in information about soil as it will give us a guideline on the support of the very basic life style in the Central Highlands. There are two types of soil in the Central Highlands, ferrasols and luvisols. Ferralsols dominate the plateau and they are characterized by a low in level of nutrients, low level of water retention capacity and low content of organic matter. These characteristics result in high rates of erosion and low crop yields, e.g., maize generating only 100-400 kg per hectare. Luvisols are found in depressive valleys and their characteristics are opposite to the ferrasols. They are productive and in high demand, resulting in a population pressure on these soils. Not all households have access to this soil. They are formed on the lowlands and valleys and they suffer from problems related to excessive water. /5/

## 19 HOUSEHOLDS FOOD SECURITY AND POVERTY PATTERNS

This is one of the most important chapters of the report including most of the statistics. It includes detailed analysis of the livelihood of the households including assets, education, living conditions and many other patterns influencing the living conditions of the people. In short it is an indicator of the vulnerability of the people living in the Central Highlands./5/

### 19.1 DEMOGRAPHICS

#### 19.1.1 HEAD OF HOUSEHOLDS

Half of the households surveyed have reported that men lead over 57% of the households and 36% are lead by the women according to Table.2. Zones 3, 4 and 7 are mainly female-headed households with the average number of family members 5 persons and an average of 1 and 2 dependents. 12% of the households surveyed have mentally or physically handicapped members and in Zone 5 the household is headed by children where the Elderly represents 5% and children 2%. /5/

#### 19.1.2 EDUCATION

The impact of war had deteriorated the level of education quite dramatically due to disruption and lots of displacement. Like in many poor and developing areas in the World the education level is quite low if not very low. The majority of the households are illiterate and very few and those who are literate; they can just read and write since the majority doesn't enroll to their secondary school (Tab.3)

Table.4 states that majority of children enroll in the primary school and however there are very few that enroll in the secondary school. Not surprising there are even adults who enroll in the primary school aged 18 and sometimes from my own experiences there are especial classes made just for adults teaching them how to read and write.

Another challenge facing these communities is not only that these are majority who are literate but the quality of education is so poor. With very few resources and

income the materials, books and teachers are of very low qualification and level. In addition, not all households can afford to pay for their children’s education. For example; there are lots of children who do not attend school for a variety of reasons such as lack of documents, absence of teachers, economic situation of the households since poor families don’t have the assets or resources to send children to schools far from home assuming that 31% who lives in the ‘Planalto’ don’t have a school near by and the nearest school is 5 km away. From my own experience I believe that in some cases the family send their children to rich people in the urban areas and get money for that in other words child labour and of coarse some girls end up marrying and getting pregnant very early on. Communities feel that their future as families and communities is compromised as education is a basic need. Communities feel that it is the role of the government to run such schools however, in my point of view corruption and poverty won’t solve much except maybe with the oil boost and the high developing rate. Otherwise families often send some of their children to relatives living in the provincial capitals however poor families usually can’t send more than me or 2 children and women taking on casual work to cover educational expenses.

School Enrolment	Primary	Secondary
Total Enrolment in Age Group	115%	11%
Total Children (5-18)	63%	5%

**Table.4 percentage of school enrolments /5/**

**Challenge to Scan-Water**

Since 60% of the household are illiterate, 73% never made it beyond primary education added very low quality of education, introduction and of the people to use such product such as Nerox-02 could be very difficult. In case where the education level is very low usually people experience difficulties in understanding the whole process. That is mainly due to reading and their writing skills. Writing a pamphlet explaining how to use Nerox-02 has to be simple, easy and clear, and it can’t include lots of scientific points or methods of its use. /5/

**19.1.3 DISPLACEMENT**

The household vulnerability status is directly linked to the displacement factor. The majority of those being displaced have been taking place in Bie (30%) and Huambo

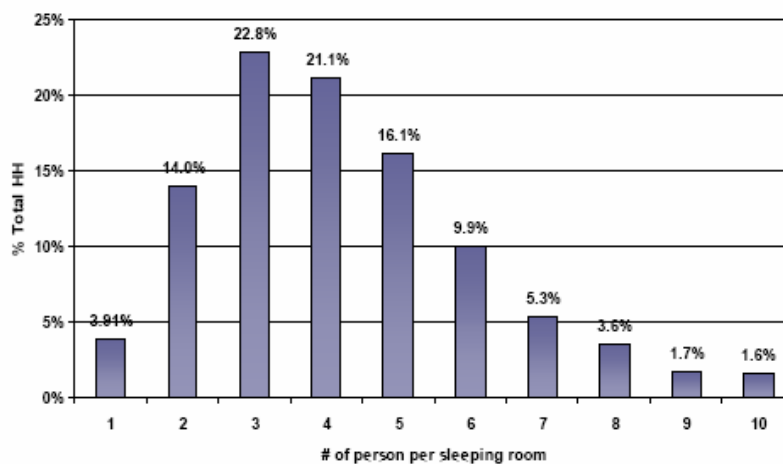


(32%) and most of the displacement was reflected in year 2002-2003, the year after the peace treaty. This has been a food challenge for the households since there are more returnees and less than two harvests. According to the survey half of the displaced population returned year 2002-2003 and it reflects 47% of the displaced population and half of these households (23% of total households) had less than 2 harvests at the time while the new returnees had almost no harvest. /5/

## 19.2 LIVING CONDITIONS

### 19.2.1 HOUSING

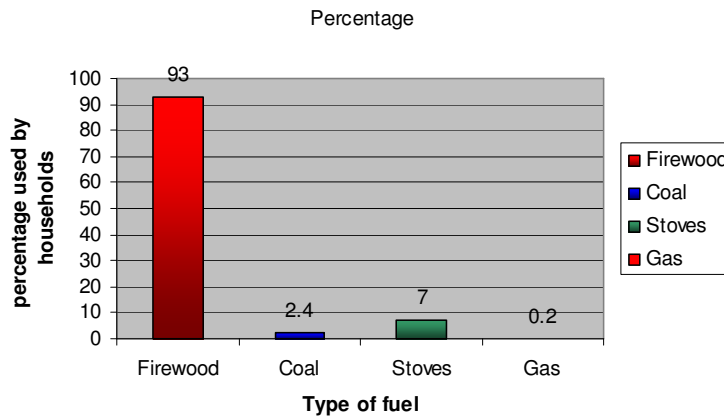
In case there will be water aid we need to estimate the average number of people in a household, their age and how much water they consume. Figure.4 illustrates the number of households per sleeping room. 82% of the people have 3 or more, even up to 10 persons living in one living room. /5/



**Figure.4 Households per sleeping room /5/**

### 19.2.2 ELECTRICITY

In rural areas, electricity is almost non-existent and this makes Scan-Water products appropriate to be used in these areas, as they rely on gravity rather than electricity. 93% of the households use firewood supplies to cook food (Fig.5). /5/



**Figure.5 Type of electricity used in %**

### 19.2.3 DRINKING WATER

One of the biggest challenges facing the Central highlands is that 96% of the population lives within 30 minutes and 66% lives within 15 minutes away of a water source. That makes water transportation an obstacle for the communities and households living in these areas. 50% of the water supply in the Central Highlands comes from rivers and springs, and at the Northern Planalto, especially zone 5 the households obtain 70% of their water from the river. /5/

### 19.3 LIVELIHOOD

In the Central Highlands agriculture is the primary livelihood with approximately 94% of the population practicing it (Tab.6). Almost all households practice agriculture and sometimes there can be other activities such as livestock and fishing.

Table.5 states that almost all households practice agriculture and sometimes there can be other activities such as livestock and fishing.

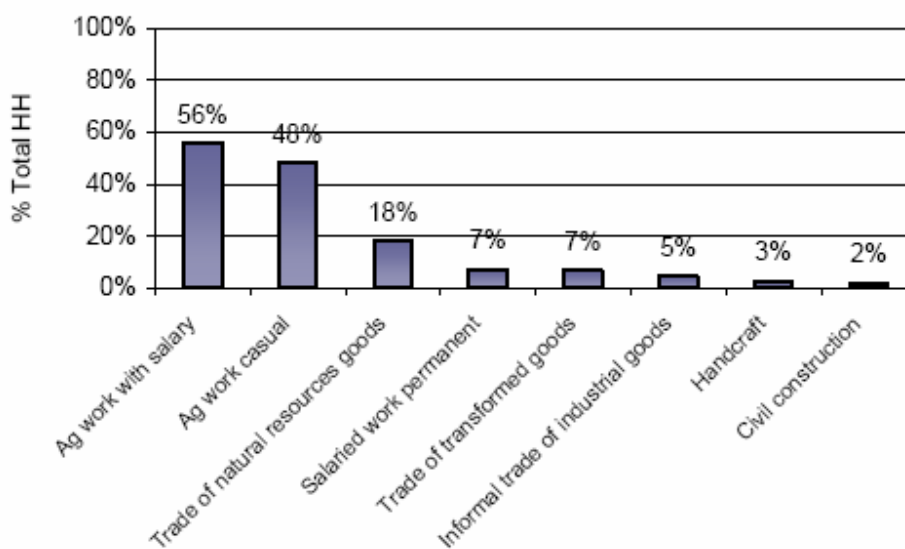
Figure.6, Additional sources of income, shows that most of the income comes from agriculture while there are few other sources of income that the population counts on. Table.6 shows the percentage of people working on more than one source of income. The majority in Zone 5 does not have any other sources of income than agricultural sources, and to make things worse, half of those working for

agriculture, work casually without a salary. However, in Zones 3, 4 and 6 people work with two to three additional income sources. In practicing agriculture, the citizens are facing lots of challenges from lack of tools, insufficiency and high market cost of seeds and fertilizers, and the low soil fertility.

. (5)

Livelihoods	%HH
Agriculture	93.3
Agriculture + Livestock	64.4
Agriculture + Fishing	5.3
Livestock only	2.2
Fishing only	0.4

**Table.5 Livelihood income strategies /5/**



**Figure.6 Additional sources of income (farm and off-farm) /5/**

# of Add'l Income sources	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Planalto
0	55%	67%	57%	54%	75%	58%	50%	60%
1	38%	27%	32%	30%	20%	19%	40%	29%
2	6%	2%	10%	14%	3%	10%	7%	7%
3	1%	3%	2%	1%	1%	11%	2%	3%
4	/	1%	/	1%	/	1%	2%	1%
5	/	0%	/	/	/	/	/	0%

**Table.6 Livelihood Diversity /5/**

## 19.4 INCOME SOURCES

The analysis indicates that the highest average income is earned from permanent salaried jobs followed by the informal trade of industrial goods and civil construction (Fig.7). However, most of the activities practiced by the households are involved in the agricultural sector and they generate the lowest income, such as working in agricultural labour (13%) or the trade of natural resources (18%).

There is very little diversity in the sources of income and to make matters worse the work is usually very hard. For example, most of the agricultural labour work in exchange for food, health and education. People selling firewood and charcoal are facing lots of challenges since more forests are degraded and the distances are getting longer, requiring more time and effort for very limited returns. Parents sometimes have to give up seeing their children in order to work in a distance place. As Josefa Nguere from Huambo says ‘The bush is finishing, if you go there you can’t cultivate, you can’t go see your children, how do you manage?’ On the other hand, there are some common products such as maize and beans which generate the highest sources of income, generating the highest sales revenue. Their cultivation is practiced by 27% of the households. The only challenge is that the competition is so high that the prices become low and generate less profit. ‘Everyone works, everyone goes to the same place to cut, and everyone sells at the same market. That’s why the prices are so low ‘Said Severina Net from Andulo (Bie). /5/

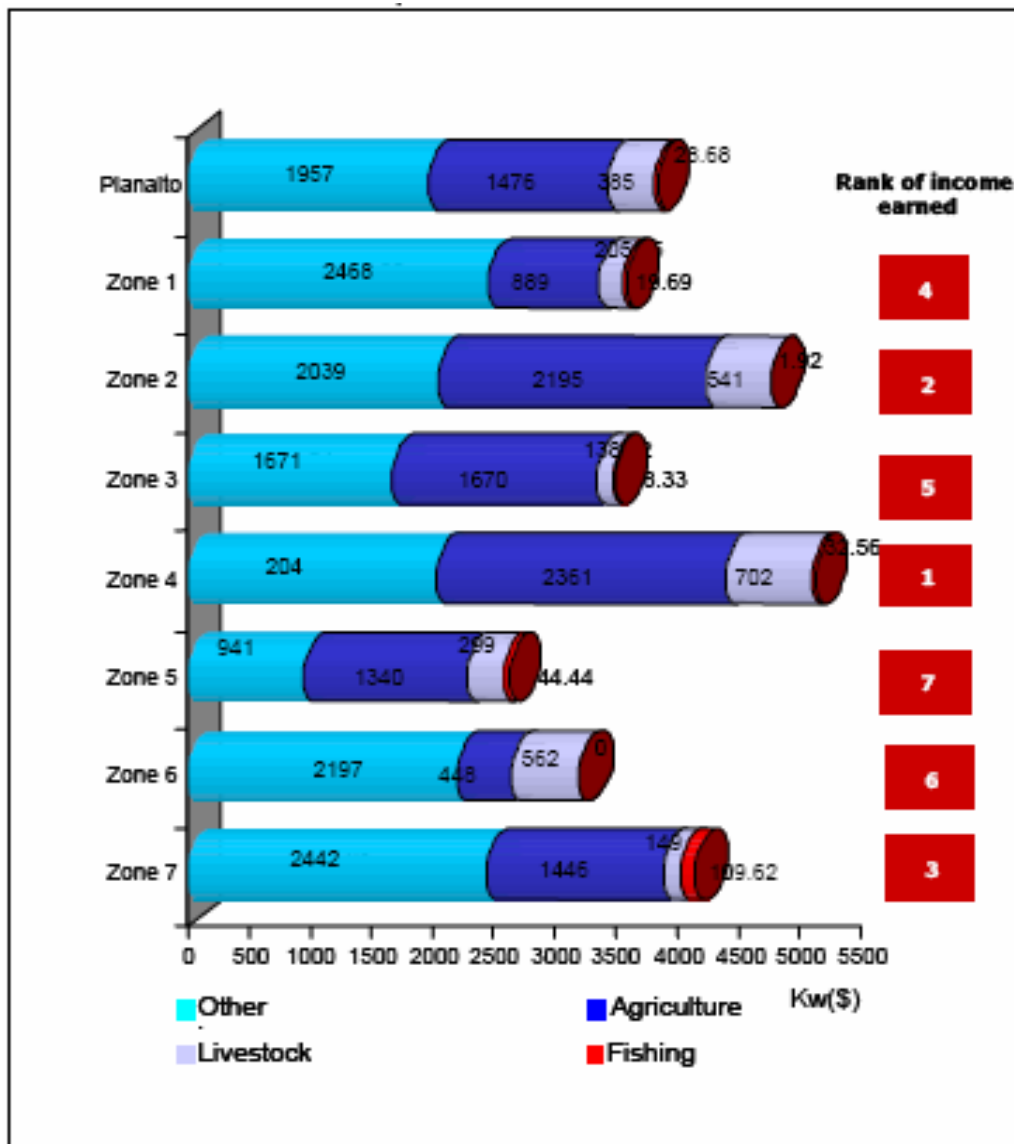


Figure.7 Monthly average income from labour and revenue from sales by economic sector /5/

### 19.5 THE WEALTH INDEX

Wealth Index is a better representative of a household's long term income and it represents better the household's capacity for facing emergency situations.

The wealth index is directly related to the ownership of assets in a household since income and sales revenue can be cut of the household if there is an economic recession.

Table.7 shows and states the wealth index of households in different zones. The table reveals that Zones 3, 4 and 7 have the lowest wealth index which means that they are the most vulnerable to emergency situations since they have relatively less assets than in any other zone. As seen from Table.7, almost all Zones except Zone 1 and 2 have a negative access to water.

From the survey it was concluded that the households headed by women tend to be wealthier and that indicates that women are concerned with providing the household livelihood guarantee. On the other side, the household headed by youngsters of course becomes more exposed to risks since they have a high dependency ratio.(5)

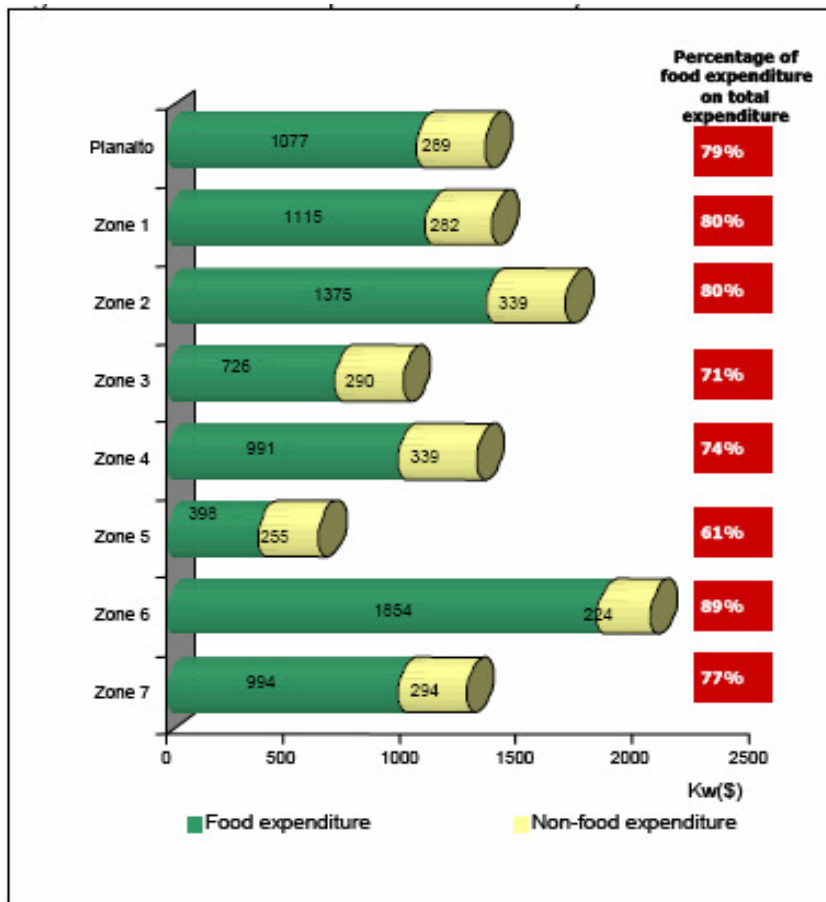
Variables	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
<b>Total income (in Kz)</b>	3.412.9	4.335.3	3.318.4	4.642.9	2.406.1	2.911.3	3.854.2
<b>Wealth index</b>	0.14	0.72	-0.26	0.03	-0.59	0.07	-0.33
<b>Rank of wealth index</b>	2	1	5	4	7	3	6
<b>House quality index and access to water *</b>	0.35	0.85	-0.09	-0.21	-0.49	-0.12	-0.75
<b>Ownership of goods and equipments index</b>	-0.05	0.31	-0.18	-0.02	-0.13	0.07	-0.09
<b>Ownership of livestock index</b>	-0.40	0.06	-0.23	0.44	-0.27	0.60	-0.14

\* Sources of energy used for lighting and cooking were also included in this category.

**Table. 7 Assets indices and average monthly income /5/**

## 19.6 EXPENDITURE

Figure.8 illustrates that most of the household income is spent on food, like in any poor area in the world. Comparing Figure.8 with Figure.7 it is obvious that the poorest zones which are 6 and 7 receive the least amount of aid. However, zone 6 seems to spend a large amount of its income on food expenditure while zone 5 spends the least on food. The explanation to this phenomenon is that in fact zone 6 has the smallest participation in agricultural sector and is producing its own food. Therefore, consumption is insufficient for the households' dietary needs. On the other hand Zone 5 receives lots of food aid which might explain the low expenditure on food. /5/



**Figure. 8 Absolute Expenditure in Kw by zone /5/**

## 19.7 ACCESS TO SOCIAL INFRASTRUCTURE AND SERVICES

### 19.7.1 ROAD AND TRANSPORTATION

The majority of the communities are connected to road networks accounting for 82%. However, 31% of that population is isolated for at least 5 months per year. In some villages there are no roads at all, the nearest is 5 km away. To complicate the matters more there are mobility restrictions due to mines in 11% of the communities. /5/

### 19.7.2 HEALTH INFRASTRUCTURE

Water transportation would be a challenge to Scan-Water in such a case. Fortunately, the majority of the communities are connected to road networks accounting for 82%. However, 31% of that population is isolated for at least 5

months per year. In some villages there are no roads at all, the nearest is 5 km away. To complicate the matters more there are mobility restrictions due to mines in 11% of the communities. /5/

### 19.7.3 Health infrastructure

*'Here there are no doctors or private nurses. Ourselves, when we can, we can buy medicines in the market because in the pharmacies they don't sell medicines without prescription. Sometimes we use roots or leaves'* Ebanga, Ganda.

As it is clear from this statement, the region has very poor health infrastructure and facilities, and the nearest health facilities are 20 km away which means that the household has to pay for expensive transportation or move by foot.

*'If someone is very sick and taken to Caconda by foot, he can die along the way...'* Caconda (Huila).

Medicines are resold by nurses, prices get high, households have to do extra work and even sell some of their assets to deal with the health problems and some of those with limited income diversity get poorer and more vulnerable. Water is available but the water quality is the centre of the problems since it deteriorates the children's health. Mothers only boil water for babies under the age of 3 months.

In addition women tend to do lots of casual work to buy medicines and pay for transportation to the health facility. They also pay the nurses with their own agricultural work or livestock; otherwise they will rely on traditional healers.

As mentioned before, transportation is an important issue in these kinds of environments. Most villagers live at a very distant place from the health infrastructure and the nearest facilities are 20 km away. As a result, the household members either have to pay price for transportation or just go by foot. /5/

## 20. INTRODUCING NEROX-02 DRINKING WATER FILTERS

Nerox is one of the most popular products manufactured by Scan-Water (former Plastec). Its design makes it a very practical solution to the water stressed countries. In our case report, Nerox can be applied for several reasons:

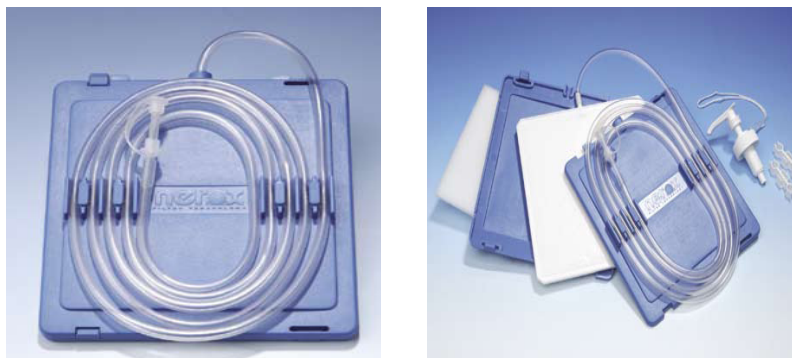
- It is very easy to use and with the poor education quality in the Central Highlands it would be easy for people from all age groups to use it.



- There is a cholera outbreak all around Angola even though it might not be as much as in the Central Highlands (with the exception of Benguela). That is a clear sign of very low water quality and polluted water. Nerox removes all disease causing bacteria and it also reduces heavy metals and pesticides.
- Assuming that people use maximum 3 litres of water per day, Nerox can provide water for a family of about 8 people per sleeping room.
- The lack of energy resources makes Nerox of a very practical use as it works by gravity (Pic.5) without electricity.
- The storage of Nerox needs to be a temperature above freezing and that makes it easy to store.
- Finally, its light weight (260 gm) makes its transportation nationally and internationally easy and cheap (Picture.6).
- It is designed to be a inexpensive purification system compared to other complex ones.



**Picture.5 Nerox-02 filter purifying water /7/**



**Picture.6 Nerox-02 filter /7/**

## 20.1 NEROX-02 INSTITUTIONAL UNIT

Different products can be applied and fit in different situations. Addressing the needs of schools, Nerox-02 institutional Unit (Pic.7) supplies an amount of 20-70 liters of water pure of heavy metals and pesticides, disease-causing bacteria and cysts. The product is best applied in remote areas and schools. The Nerox-02 Institutional Unit is very easy to use. The water unit supply depends on the number of filters installed inside the unit. Besides, it is very light in weight and best of all it works with gravity and no electricity is required.



**Picture.7 Nerox-02 Institutional unit /7/**

## 20.2 NEROX-02 FAMILY KIT

The family kit (Pic.8) supplies water to households and family members up to 4 people. However, that can be a challenge since the average number of people in the household in the Central Highlands averages to 5 persons per household. Figure 7 illustrates that there is a large amount of households having 4 or more persons living per sleeping room. There, in some cases less purified water will be needed per day.



**Picture.8 Nerox-02 family kit /7/**

## 21. ADVANCED SCAN-WATER SOLUTIONS

Scan-Water can also supply bigger and simple solutions for households, schools members, schools, and even for travellers.

However, water still needs to be transported as 90% of the population lives within 30 minutes distance from the nearest water source and the rest within about 15 minutes distance. In addition, the roads and transportation systems are poor.

By combining products that are classified into the following categories; transport, purification, storage and distribution a more complex system can be formed providing water to over 5000 villagers (Pic.10). /7/

### 21.1 EMERGENCY DRINKING WATER KIT

This kit is very practical. There are more complex solutions however, for the groups of people who go to collect water. The U-Bag is very light in weight and it does serve many purposes, it can take up to 10 litres of water.

Therefore, it makes it suitable for a small group or family. It looks as Emergency Drinking Water Kit (Pic.9) can be best used by those who take a 30 minutes walk to the water source. The kit works by gravity as illustrated, by placing the Nerox-02 filter inside the U-Bag and making the water flow to the U-Can. Their light weight

and the material they are composed of makes it very practical to transport them around even in a very small kit (Nerox Travel Kit).

The Nerox-02 Emergency Drinking Water Kit (Pic.9) provides safe drinking water for families and small groups. It consists of three components:

- a) The U-Bag which is used to carry solid foods as well, capacity up to 10 kg/15 l of grain/rice/beans/flour.
- b) The Nerox-02 Filter it is an inexpensive and efficient filter that removes all disease-causing bacteria and cysts. The concentration of the heavy metals and pesticides can be reduced significantly.
- c) The U-Can with a screw cork which is a collapsible jerry can for purified drinking water, capacity up to 10 liters.

The emergency kit is characterized by its very light weight (600 gm), and it provides 15-25 liters of purified water per day. It consists of the Nerox-02 filter, sponge, hand pump, screw cap, 2 tube chips, U-BAG and U-CAN. The membrane has to be cleared with soft sponge followed by disinfection of bags with a suitable dish liquid and chlorine for domestic use twice a week.



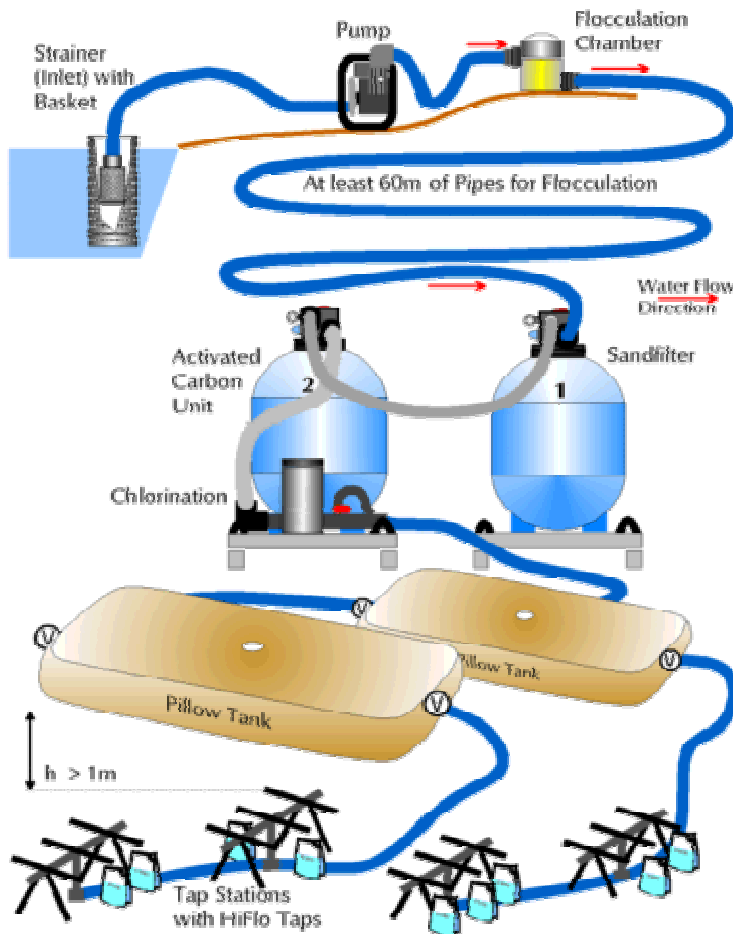
**Picture.9 Emergency drinking water kit /7/**

## 22.2 EM WAT KIT 4000

The EM Wat 4000 (Pic.10) kit is a complete system for drinking water purification that supplies water to a small village of 5000 persons with a daily need of drinking water.

The system is very effective. The Central Highlands suffer greatly from a lack of water distribution system, and the water resources are very far away from villages. Carrying water is done on the expense of education and school attendance especially for girls. The drawback of such this system is that it is more expensive and more complex than the Nerox-02 series however; it is a full system with an extreme advantage of distributing water from its source. Further, the system is still cheaper and very effective compared to other water purification systems.

(Picture.9) is shows the system structure where water is pumped and then enters the flocculation chamber where particles are clump together to flock floats of the top of the liquid and then settles to the bottom allowing the water to pass through the sand filter. Unlike any other filtering method the sand filters use biological process to clean the water and are nonpressurized systems and filter system does not require chemicals or electricity to operate. That been said sand filters work more efficiently if the water is not very turbid. The water is than is pumped into the activated carbon which is effective especially cleaning households water filters and fish tanks. The activated carbon absorb many toxic elements besides it can realease silver ions that are antibacterial. The water than is chlorinated and the process kills lots of many microorganisms. The water them is stored into the pillow tanks. The pillow tanks capacity carries from 3000 litres of water to 50,000 litres of water. After that the water will flow to the tap stations with HiFlo Taps where people from the community can restore the water in their Emergency Drinking Water Kit (Picture.8) or any other for that matter. /7/



**Picture.10 The EmWat kit 4000 water purification process taking place for clean water supply for village. /7/**

## 23. SCAN-WATER SUCCESS STORIES

Scan-Water has cooperated with many organizations such as World Vision, UNICEF, WFP and many others. Below we present some projects which took place in Pakistan, Sri Lanka, KwaZulu (South Africa), Kenya and Afghanistan. /7/

### 23.1 CASE 1: PAKISTAN

The Norwegian government donated 5000 Emergency Drinking Water Kits from Nerox, which were used after the Earthquake struck in Pakistan, to produce safe drinking water without the use of chemicals or sources of energy. The local

municipalities were trained on how to use the system before distributing the kits to the end users./7/

## 23.2 CASE 2: SRI LANKA

Sri Lanka was one of the adversely affected countries after the earthquake and the tsunami that followed in 2004. Scan-Water purification units were in operation and provided drinking water to approximately 5000 homeless people in Batticaloa. Other regions were supplied with safe drinking water. In addition, Nerox Emergency kits and water storage tanks were delivered during the relief operation. /7/

## 23.3 CASE 3. KWA ZULU

Kwa Zulu Natal was hit by a cholera epidemic in 2001. The Norwegian Foreign Office deployed 7 Em Wat Kits in the Showe area. The project was overseen by Senzokuhle CBO Network based in Eshowe. /7/

## 24 SCAN-WATER SUCCESSFUL PROJECTS

### 24.1 HYGIENE AND SANITATION IN KENYA

Project WASH (Water Sanitation Hygiene) was funded by the Norwegian Government and UNICEF in Turkana District in Northern Kang, Kenya to train groups of women to use Nerox Drinking Water Filters and to apply better hygiene (Pic.11). The women were sent to train their own group and relatives and the project was successfully involving people in the whole village through songs, drama and competition, a method known also as social marketing.

The project was highly evaluated by UNICEF and is likely to expand in near villages. /7/



**Picture.11 A Kenyan woman using Nerox-02 filters /7/**

## 24.2 SCHOOL WATER PROJECT IN AFGHANISTAN

Nerox School Project was developed in Afghanistan (Pic.12) to teach children about hygiene and taking responsibility of their own drinking water. The pilot project was conducted with the WFP as part of a school feeding program.

In the project, craftsmen were making their own water containers with the design provided by Scan-Water technical departments. Standard components and Nerox filters were adapted to the system.

Scan-Water School Project helps organizations to meet the Millennium-Development Goals by providing safe drinking water to schoolchildren and therefore enhancing children's health and learning abilities. /7/



*Nerox School Kit in Afganistan.  
Photo by: Mark Agoya WFP*

**Picture.12 Afghani school children drinking clean water after use of water /7/**



## 25. DISCUSSIONS

According to Agenda 21 of the UN Division for Sustainable Development it is crucial to fund developing countries, especially the least developed, to implement sustainable development. The main external resource for this target is the Overseas Development Assistance (ODA), where it is requested that developed countries reaffirm their commitments to reach the accepted United Nations target of 0.7 per cent of GNP for ODA.

Other methods of raising funds for environmental actions include:

- Public and private revenues.
- Debt reduction especially from industrial countries.
- National and international environmental funds.
- Joint Implementation Programs.

The data states that there has been a rise of the ODA commitments for the conservation and management of resources in 1990-1999 from US\$5300 million to US\$6500 million.

There are also some capital flow problems in poor countries, especially the African countries, since they are very discouraging for foreign direct investment (FDI) to invest due to the high level of corruption and political problems therefore there are less investments and less profit to pay their debts.

Fortunately, there has been some progress towards a nominal debt relief from HIPC (Heavily Indebted Poor Countries). In January 1999 it was found that 10 out of the 12 countries that are considered to be HIPC are in Africa but Angola doesn't seem to be included on that list.

There has been a concern in regard to financing environmental activities in Africa and according to CSD (Commission on Sustainable Development of the UN 1997) these has been successful for many factors. Firstly, there has been public sector financing from African countries in addition to the national institutes that have been established in most African countries demonstrating an increase in the political and financial commitment to this sector. The African countries' public sectors have been financing the environmental activities in cash or through inland counterpart funding projects.

As a result, there has been a pool of revenues from various resources such as earmarked taxes, debt for nature swaps and concessional grants or loans which they are long-term funding for environmental programs.

There have been many effective ways to support environmental programs and all can be applied in our case study Angola.

In some countries such as Madagascar, Sudan and Zambia part of the country's external debt has been converted into a domestic obligation to support environmental activities and programs. This process is called a debt-for-nature swap and the funds are used to support ecosystem management of protected areas, for environmental education, sustainable development and inventories of endangered species. Part of sustainable development is improving water quality (Millennium Table.1).

Another way to finance environmental activities is through an international finance mechanism such as the Global Environment Facility (GEF) and the Multilateral Fund for the Montréal Protocol. Both transfer funds to developing countries, and Africa has allocated 22% of the funds received from GEF countries, totaling of US\$ 419 million in the following activities; Biodiversity 33%, Funding for International waters 38% and Funding for climate change activities 11%.

Another very interesting way to encourage funding by the World Bank in environmental and social projects was to increase the interest of investors in the developing countries in those areas. As a result there has been over a 100% increase in the environmental projects investments over a 7 year period from US\$ 282 million. There were 56 World Bank financial environmental projects in African countries accounting to US\$898 million. Those finances originate from different sources such as bilateral, governments, NGOs, multilateral donors and the private sector.

Regardless of the increase in financial resources there is still much more to be done especially from the private and public capital flows to this sector. Relying on external sources only is not sufficient especially after the falling of the ODA and the unfulfilled UNCED commitments to increase the ODA to the level necessary to implement Agenda 21, and reducing the debt burden. Therefore there need to be reforms in the public expenditure and greater private sector participation. /3/

## 25.1 PUBLIC PARTICIPATION AN IMPROVE LIVES OF PEOPLE IN THE CENTRAL HIGHLANDS

These points address the effects and advantages of public participation:

- Local people often know about the causes and remedies of such problems.
- Public participation encourages people to take more action and responsibilities and therefore governments can address the environmental issues more explicitly and more effectively.
- Public participation allows people to be more aware and more knowledgeable about their situation thus taking action.
- Public participation increases the effectiveness of government initiatives as the knowledge, the skills and resources need to be mobilized.
- In Africa there are some problems when it comes to involving women and youth in decision making however involving them can increase the awareness when it comes to gender equality.

## 25.2 ENVIRONMENTAL INFORMATION AND EDUCATION

Involving the public helps environmental policies to be implemented effectively and many governments have achieved that through involving responsibilities of the private sector, academic community, NGOs and community groups, as noted in the 1992 Earth Summit.

Environmental awareness and education programmes have expanded through the area and students can learn how to use the water purification products, purify water naturally, the causes of cholera and its presentation and the role of women in the society.

Apart from school there are other non-formal ways to increase this kind of awareness. Educational programs are demonstrated in conservation projects, newsletters, posters, radio and television programs, seminars and workshops. However, these can be very challenging in our case due to the education and literacy level and the available assets. Only 30% of the population owns a radio and 1% own electric appliances (Figure.2: Households assets ownership by type).

However, those who are aware within the community can be responsible for providing the information. A success story is Niger where tree planting, soil conservation and restoration projects have been implemented in a voluntary basis by students and community groups.

## 26 CONCLUSIONS

In my point of view, addressing and improving the lives of poor people in developing countries is an ethical issue. An article from the United Nations supports my view that poverty is a cause and a product of human rights violation.

Peoples whose rights are denied are usually victims of discrimination or persecution. People find it hard or even impossible to participate in labour market and almost lack access to their very basic right of education, health, and housing simply because they can't afford them.

Poverty afflicts all human rights for example people with low income will prevent them from accessing education, economic and social rights, inhibits their participation in public life, political life and their ability to influence policies affecting them.

However, poverty is rarely seen through the lens of human rights but rather perceived as tragic but inevitable and to even as the responsibility of those who suffer it. At best these living in areas in developing countries are portrayed as unfortunate, at worst as lazy and undeserving.

Factors such as discrimination, unequal access to resources and social and cultural stigmatization have always made a good recipe for poverty. These factors have another name and we could call it '*The denial of human rights and dignity*' because these factors are the responsibility of governments and those in position of power to be obliged to do something about since they have committed and signed to international goals such as the 'Millennium Declaration and Millennium Development Goals' to make poverty history. (Human Rights Appendix)

In my conclusion, I am going to focus on technical solutions rather than preventions. In other words I am addressing the 'Cure' rather than the 'Prevention'. Solving water issues in the slum areas of Angola can improve life standards

dramatically as seen in (Tab.1). One way to achieve that is to find the solutions for improving. I believe that is to find the solutions for improving. I believe that Nerox products apply very well in here since they are cheap, reliable, don't require electricity, light in weight and easy to use (See section 20). Nerox has had many successful projects and has collaborated with many organizations to provide emergency drinking water to developing countries. However, still people living in slums as those living in the Central Highlands of Angola won't be able to afford Nerox equipments and there, and therefore it becomes an ethical issue on an individual level and even international level. Even though the Norwegian organization or other organization such as United Nation, World Food Programme, Red Cross etc... it is our duty as individuals to support the lives of these people. A dollar can make a family live for a whole day. /10/

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## 28 APPENDIX

### ***Article 1.***

All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.

### ***Article 2.***

Everyone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status. Furthermore, no distinction shall be made on the basis of the political, jurisdictional or international status of the country or territory to which a person belongs, whether it be independent, trust, non-self-governing or under any other limitation of sovereignty.

### ***Article 3.***

Everyone has the right to life, liberty and security of person.

### ***Article 4.***

No one shall be held in slavery or servitude; slavery and the slave trade shall be prohibited in all their forms.

### ***Article 5.***

No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment.

### ***Article 6.***

Everyone has the right to recognition everywhere as a person before the law.



***Article 7.***

All are equal before the law and are entitled without any discrimination to equal protection of the law. All are entitled to equal protection against any discrimination in violation of this Declaration and against any incitement to such discrimination.

***Article 8.***

Everyone has the right to an effective remedy by the competent national tribunals for acts violating the fundamental rights granted him by the constitution or by law.

***Article 9.***

No one shall be subjected to arbitrary arrest, detention or exile.

***Article 10.***

Everyone is entitled in full equality to a fair and public hearing by an independent and impartial tribunal, in the determination of his rights and obligations and of any criminal charge against him.

***Article 11.***

(1) Everyone charged with a penal offence has the right to be presumed innocent until proved guilty according to law in a public trial at which he has had all the guarantees necessary for his defence.

(2) No one shall be held guilty of any penal offence on account of any act or omission which did not constitute a penal offence, under national or international law, at the time when it was committed. Nor shall a heavier penalty be imposed than the one that was applicable at the time the penal offence was committed.

***Article 12.***

No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation. Everyone has the right to the protection of the law against such interference or attacks.

***Article 13.***

(1) Everyone has the right to freedom of movement and residence within the borders of each state.

(2) Everyone has the right to leave any country, including his own, and to return to his country.

***Article 14.***

(1) Everyone has the right to seek and to enjoy in other countries asylum from persecution.

(2) This right may not be invoked in the case of prosecutions genuinely arising from non-political crimes or from acts contrary to the purposes and principles of the United Nations.

***Article 15.***

(1) Everyone has the right to a nationality.

(2) No one shall be arbitrarily deprived of his nationality nor denied the right to change his nationality.

***Article 16.***

(1) Men and women of full age, without any limitation due to race, nationality or religion, have the right to marry and to found a family. They are entitled to equal rights as to marriage, during marriage and at its dissolution.

(2) Marriage shall be entered into only with the free and full consent of the intending spouses.

(3) The family is the natural and fundamental group unit of society and is entitled to protection by society and the State.

***Article 17.***

(1) Everyone has the right to own property alone as well as in association with others.

(2) No one shall be arbitrarily deprived of his property.

***Article 18.***

Everyone has the right to freedom of thought, conscience and religion; this right includes freedom to change his religion or belief, and freedom, either alone or in community with others and in public or private, to manifest his religion or belief in teaching, practice, worship and observance.

***Article 19.***

Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers.

***Article 20.***

(1) Everyone has the right to freedom of peaceful assembly and association.

(2) No one may be compelled to belong to an association.

***Article 21.***

(1) Everyone has the right to take part in the government of his country, directly or through freely chosen representatives.

(2) Everyone has the right of equal access to public service in his country.

(3) The will of the people shall be the basis of the authority of government; this will shall be expressed in periodic and genuine elections which shall be by universal and equal suffrage and shall be held by secret vote or by equivalent free voting procedures.

***Article 22.***

Everyone, as a member of society, has the right to social security and is entitled to realization, through national effort and international co-operation and in accordance with the organization and resources of each State, of the economic, social and cultural rights indispensable for his dignity and the free development of his personality.

***Article 23.***

(1) Everyone has the right to work, to free choice of employment, to just and favourable conditions of work and to protection against unemployment.

(2) Everyone, without any discrimination, has the right to equal pay for equal work.

(3) Everyone who works has the right to just and favourable remuneration ensuring for himself and his family an existence worthy of human dignity, and supplemented, if necessary, by other means of social protection.

(4) Everyone has the right to form and to join trade unions for the protection of his interests.

***Article 24.***

Everyone has the right to rest and leisure, including reasonable limitation of working hours and periodic holidays with pay.

***Article 25.***

(1) Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.

(2) Motherhood and childhood are entitled to special care and assistance. All children, whether born in or out of wedlock, shall enjoy the same social protection.

***Article 26.***

(1) Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit.

(2) Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance and friendship among all nations, racial or religious groups, and shall further the activities of the United Nations for the maintenance of peace.

(3) Parents have a prior right to choose the kind of education that shall be given to their children.

***Article 27.***

(1) Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.

(2) Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.

***Article 28.***

Everyone is entitled to a social and international order in which the rights and freedoms set forth in this Declaration can be fully realized.

***Article 29.***

(1) Everyone has duties to the community in which alone the free and full development of his personality is possible.

(2) In the exercise of his rights and freedoms, everyone shall be subject only to such limitations as are determined by law solely for the purpose of securing due

recognition and respect for the rights and freedoms of others and of meeting the just requirements of morality, public order and the general welfare in a democratic society.

(3) These rights and freedoms may in no case be exercised contrary to the purposes and principles of the United Nations.

***Article 30.***

Nothing in this Declaration may be interpreted as implying for any State, group or person any right to engage in any activity or to perform any act aimed at the destruction of any of the rights and freedoms set forth herein. (11)