SDP 10

Water use and environmental conditions along the Etaka Canal in north-central Namibia

2001/2002

Authors:

MN Akawa, KJ Andreas, TN Endjala, A-L Halundonga, E Hamukoshi, D Iiyambo, T Mbango, S Mulonga, P Muteyauli, M-L Nghikembua, K Nkandi, B Steenkamp, U Uazukuani.

Introduction

The Cuvelai-Etosha Basin area is centrally located on the northern border of Namibia. It is semi-arid, and traversed by shallow, ephemeral watercourses called oshanas, which originate from Angola and flow southward. The drainage lines of the oshanas converge near Lake Oponona and then flow into Etosha pan. Mopane shrubland and saline grassland are the dominant land types in the area. The Oshana area is fairly densely populated with about 100 people per square kilometer. The livelihood of the majority of the people in this area depends mainly on land for subsistence farming, firewood and water.

The main objectives of this study were to determine the water balance of Olushandja dam, to assess the potential for distribution of water along the Etaka Canal flowing out of Olushandja, to assess vegetation conditions and land uses and to investigate the assets, dynamics and conditions of the Lake Oponona area.

The Etaka system is a part of a natural drainage system which has been further excavated. It serves as an earth-lined water carrier including the dams and pans that are fed by it. The canal extends from Olushandja, a balancing dam, down to Lake Oponona in the saline grasslands of central northern Namibia. Dam surveying techniques, water balance modelling, observations, information exchange with residents, grass composition, biomass and woody vegetation assessments and soil analyses were the main tools used in the study.

The water balance model revealed that the entire volume of the Etaka system is only 24% of the water volume that evaporates from the Olushandja dam over a four-month period (Oct-Jan). Hence, it might be sensible to release more water into this system from the Olushandja dam on an ongoing basis. Although the evaporation rate of the Etaka system is also high, this action would decrease travel time to and from water for livestock and people. Further studies to determine the viability and long-term environmental impacts of this option are recommended.

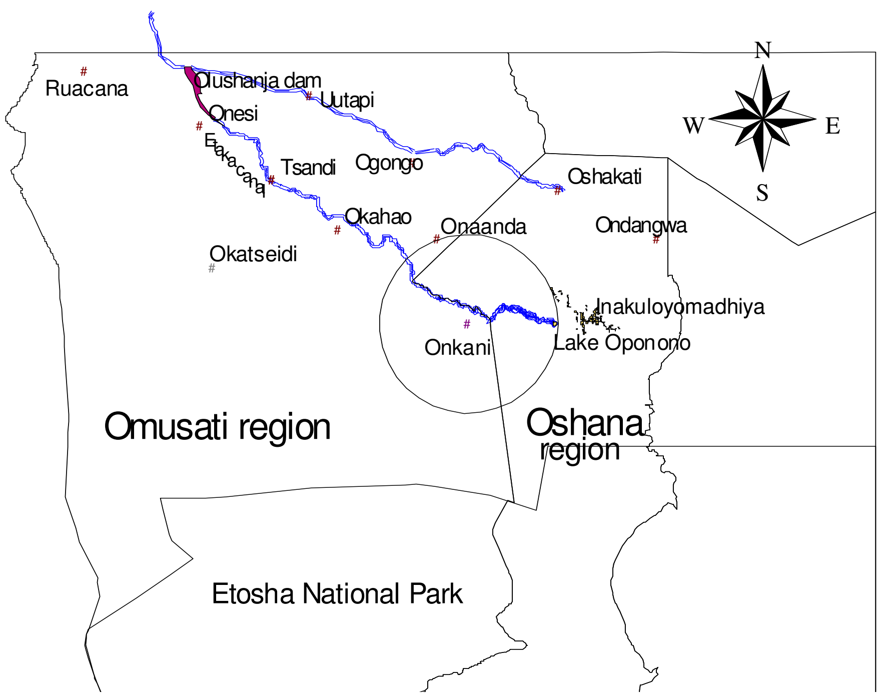
A number of water bodies in the study area were found to be rich in fish resources. Local people use traditional fishing gear like oshongo to capitalise on the available resource. However they were seen only fishing in the shallow water bodies. Apparently, local people cannot afford the commercial fishing gear that people coming from afar use to fish in the deep-water bodies. Local regulations for fishing are not respected and the large nets adversely affect the water quality, especially in Lake Oponona.

Water quality tests of different water sources indicate that pipeline water is the safest for drinking. However, in the future, the considerable costs of treating and supplying the water may be transferred from the government to the users, thus encouraging the use of other, freely available water sources.

The sandy saline soils of the Oponona grasslands do not favour the growth of palatable grasses, nor woody species. Mopane, the dominant shrub species, is probably being exploited for wood at an unsustainable rate. It is recommended to promote alternatives for cooking and building materials, thus decreasing the amount of wood necessary for domestic uses.

Following this study by students participating in SDP 11, the bulk water supplier, NamWater, tested the release of water down the Etaka canal for use by livestock. While this approach proved to be technically possible, the question remained as to who would pay for the water consumed and how would payment be collected. Although the water would be cheaper to supply and use for livestock than purified water, management and social complications prevent application of this method for water supply.

The study area



People:

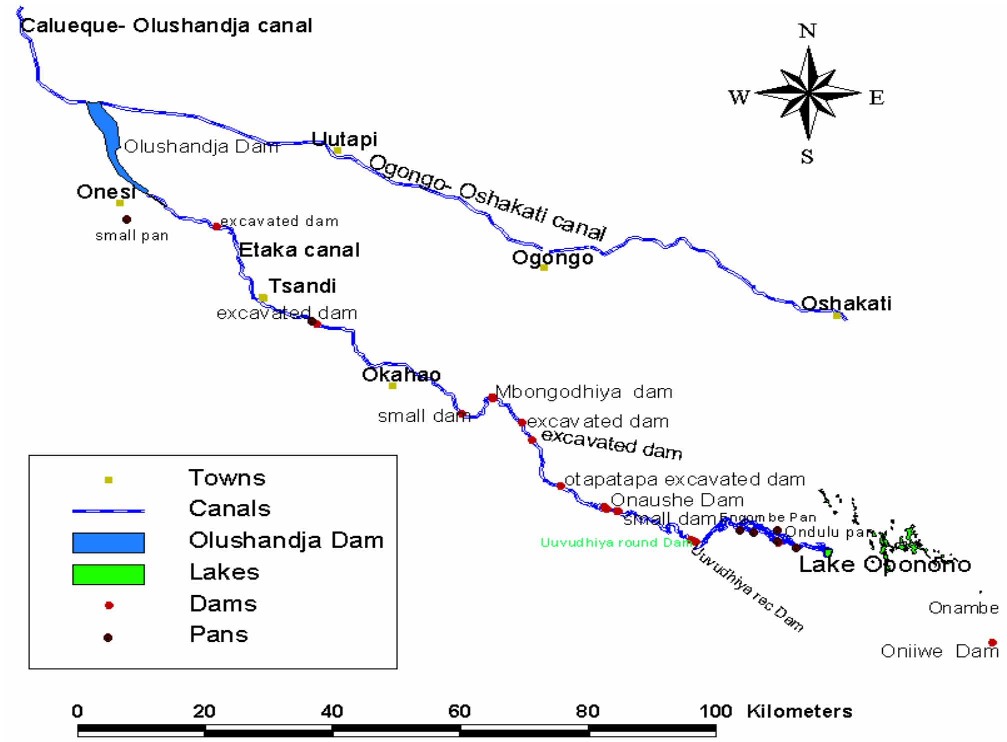
- The Oshana area has been occupied by hunter-gatherers for about 100 000 years
- The population has grown from about 90 000 in 1921 to 615 00 in 1991
- About 80% of the population of the Oshana area live in rural settlements with a density of up to 100 people/km^2
- The majority of people in the study area depend directly on natural resources such as firewood, water and land for subsistence farming – mainly livestock farming
- The average annual income in rural districts is about N$250/person
- The size of a household is closely related to its overall wealth: the richer it is, the larger the household. The important consequence of this is that wealthy homes, with the biggest fields and herds, control and use far more natural resources than smaller, poorer households.

Water :

- The Oshana area is semi-arid with an annual rainfall ranging from less than 300mm in the west to more than 550mm in the east
- Rainfall is highly variable and falls in the summer (Oct. – April)
- Evaporation and evapotranspiration rates are very high
- Natural water sources in the area comprise shallow bodies such as Lake Oponona and some pans, the water of which is turbid and not fit for drinking
- The Etaka Canal is approximately 145 kilometres long. It obtains water either from local rainfall, efundja (floods) and most significantly when water is released from the Olushandja dam into the canal.

Vegetation:

The dominant vegetation types of the study area are mopane shrubland and saline grasslands found within four different landscapes. These are the Cuvelai, mopane shrubland, eastern Kalahari woodlands, and salt pans and surrounding plains. Large trees and shrubs with deep penetrating roots dominate the vegetation of this area. Soils in the study area and the whole of the Oshanas are sandy and porous, with a harder layer more than half a meter below the surface. They are generally infertile, being low in many major nutrients, and contain little organic matter. These characteristics give the area a very low potential for crop production



Water balance of the Olushanja/Etako system

The Etaka canal system consists of the Calueque-Olushandja inflow canal, Olushandja- Ogongo outflow canal, Olushandja dam, Etako outflow canal, Lake Oponono, and excavated dams and natural pans in the area.

From interviews, use of Global Positioning System (GPS), and available Geographic Information System (GIS) data, it was established that there are an estimated 3 555 homesteads within 3km of both sides of the Etaka canal with an average of 10 cattle per household and 245 cattle per cattle post. This leads to a monthly water demand by cattle from the canal system of 51 300m^3. The monthly water demand by cattle directly from Olushandja dam has been calculated to be 9 045m^3 and represents cattle from 670 homesteads. This indicates that the Etaka canal serves as a water source for many more cattle than Olushandja dam.

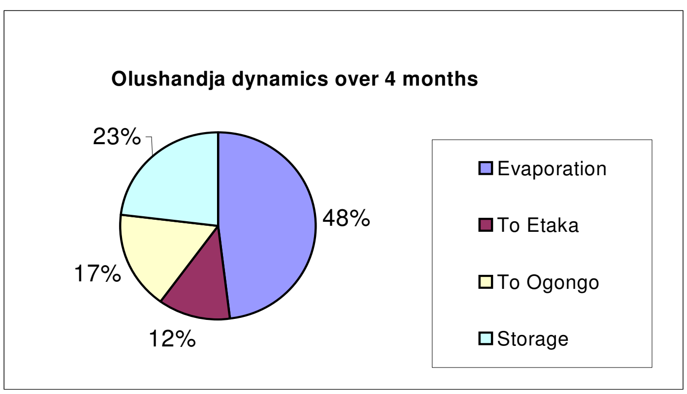
It was found that the entire volume of the Etaka system is only 24% of the volume that evaporates from Olushandja dam over four months (Oct-Jan). Only 12% of the Olushandja dam volume at half-capacity would be required to fill the whole Etaka canal system.

When Olushandja Dam is kept at half its capacity, total abstraction and evaporation of the Etaka canal system and the Olushandja Dam as well as the amount that would be required to refill them are as shown. Water loss through infiltration is unknown and therefore included in the percentage evaporation.

	Etaka system (full)	Olushandja Dam (half-full)
Surface (million m^2)	2.34	15
Volume (million m^3)	2.74	23.5
Total abstraction over 4 months (million m^3)	0.21	5.4
Evaporation volume after 4 months (million m^3)	2.50	11.3
Storage after both evaporation and abstraction after 4 months (million m^3)	0.04	6.9
Evaporation as % of volume	91%	48%
Etaka system capacity as % of evaporation volume of Olushandja dam	24%	
Etaka system capacity as % of Olushndja dam	12%	

The water level in the pans and dams is highly dependent on rainfall except in *ad hoc* cases when NamWater releases water down the canal.

Due to the large surface area of Olushandja dam, the evaporation rate from this dam is very high, 48% of its summer storage (Oct-Jan) at half capacity. The dam is normally kept at half capacity, and with that volume, it can supply both the Oshakati purification water works for pipeline demands and fill up the Etaka canal system for about half a year before it would dry up.

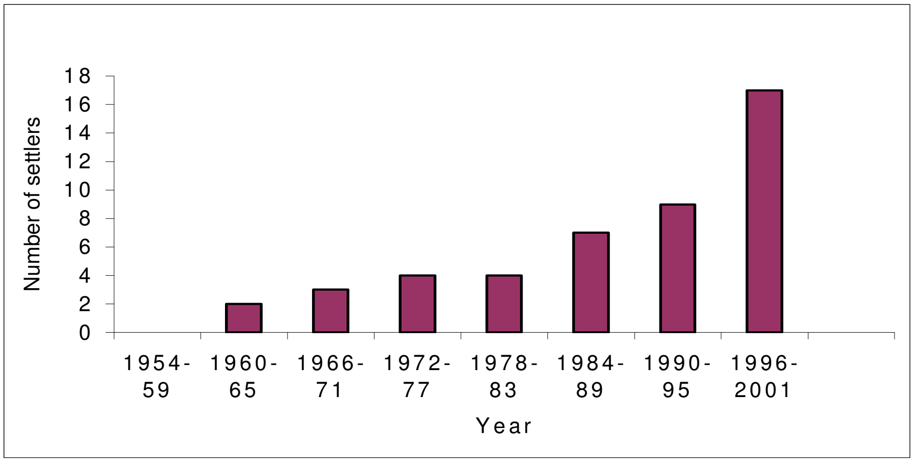


About half of the volume (48%) of the summer storage volume of the Olushandja Dam evaporates over a period of four months (Oct-Jan). This calculation assumes that the Etaka canal has been filled.

Due to the fact that most of the water kept in Olushandja dam is lost through evaporation, it might be sensible to release water into the Etaka Canal from Olushandja dam on an ongoing basis. Even though the evaporation rate of the Etaka Canal is also great, this action would allow some of the water to be used for livestock and other purposes before evaporation. Permanent water in the canal would decrease travel time to and from water for livestock and people but might expose people to increased disease risk (diarrhea, Bilharzia and Malaria). Additional studies could be conducted to determine the viability of this option.

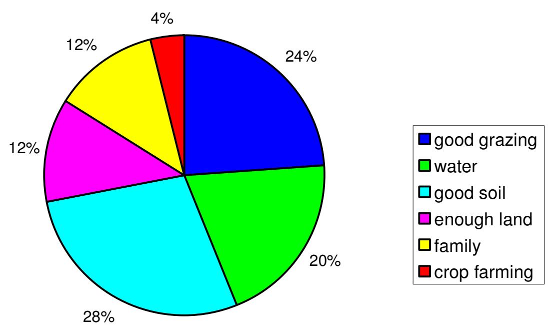
Settlement and livelihood

There has been a constant increase in the number of settlers into the area since the 1960s, which is still continuing. The rate of settlement has almost doubled the population between 1996 and 2001. As a result the resource base of the area is declining.



***Time of arrival of 46 respondents*.**

This increase is due to pull-factors including good grazing and unoccupied pieces of land. The establishment of a pipeline during the 1990s has led to a change in water source and has further contributed to the increase in settlement.



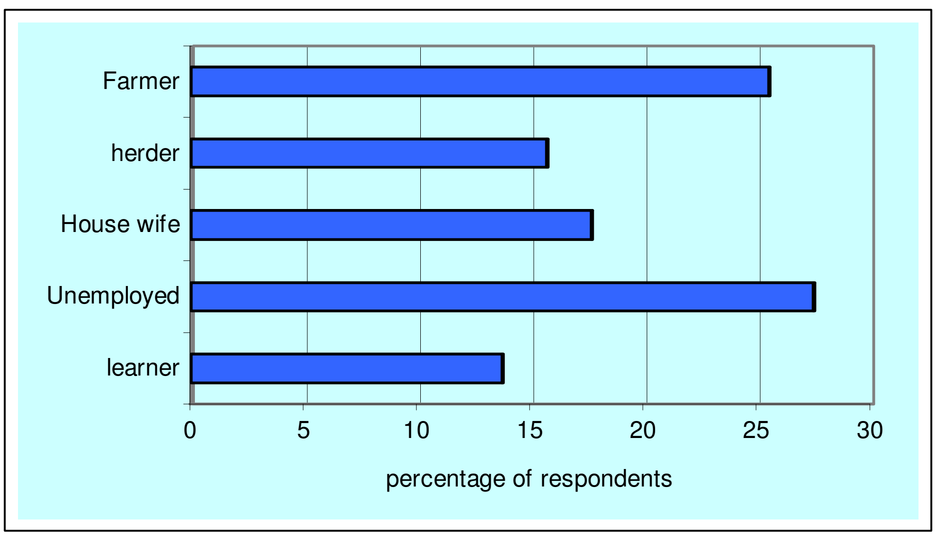
Factors attracting settlement in the area (N=25).

This study identified an average of 10 people per household, with the exact number per household depending on environmental features such as soil quality, vegetation and water availability. The majority of informants were permanent settlers. The few temporary settlers have set up their cattle posts in the area to take advantage of the available grazing. Information gathered indicates that temporary settlers are the same people who will later become permanent settlers.

Even though there are some unoccupied pieces of land, suitable farming areas for mahangu cultivation are fully occupied by existing farms. Those who settled 20 or more years ago have developed large households, farms and herds. The main land-use activities in the area are livestock grazing and cultivation of mahangu (the staple food in central northern Namibia), sorghum, used mainly to make traditional beer, and other crops such as leguminous beans and Bambara nuts which are intercropped with mahangu and contribute to soil fertility through nitrogen fixing processes.

There is high unemployment in the area and many of those who are employed work in the informal sector. This is demonstrated by 27% of unemployed respondents in the area, mainly the youth that have dropped out of school.

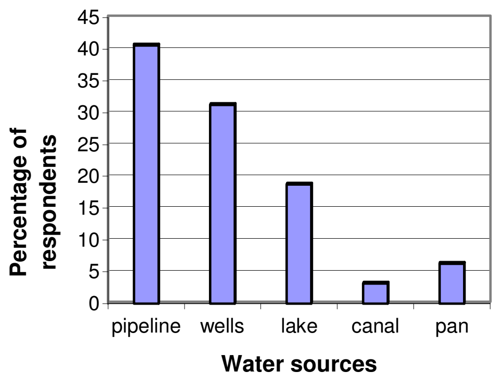
Fish resources are among the most economically valuable resources in the region as they can be used either for household consumption or to generate cash income. Even though most people in the region opt to keep large numbers of livestock, they are not necessarily kept for economic gain but to assure their own future survival. It is this large number of livestock that stays in a limited area for a long time, especially with the fading away of the traditional transhumance system, which could lead to overgrazing and thus desertification in the near future if no appropriate remedial efforts are put in place.



Social status of respondents (N=51).

Some residents rely on cash income from selling fish or mahangu in Oshakati. Unreliable rainfall and erosion of soil fertility poses a threat to residents' incomes as they cannot produce surpluses of mahangu and their livestock die from starvation.

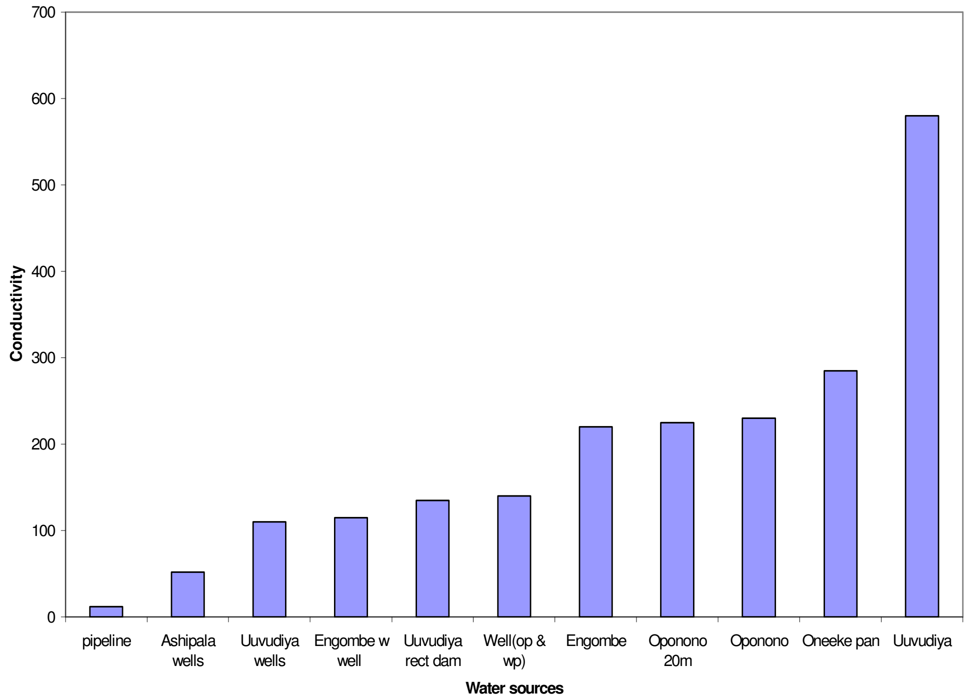
The pipeline is the main source of water in the area, while other sources include wells, pans, Etaka canal and Lake Oponona. However, for some people water is not easily accessible, with some having to travel up to 8km to a water point.



Main water sources for domestic consumption (N=32).

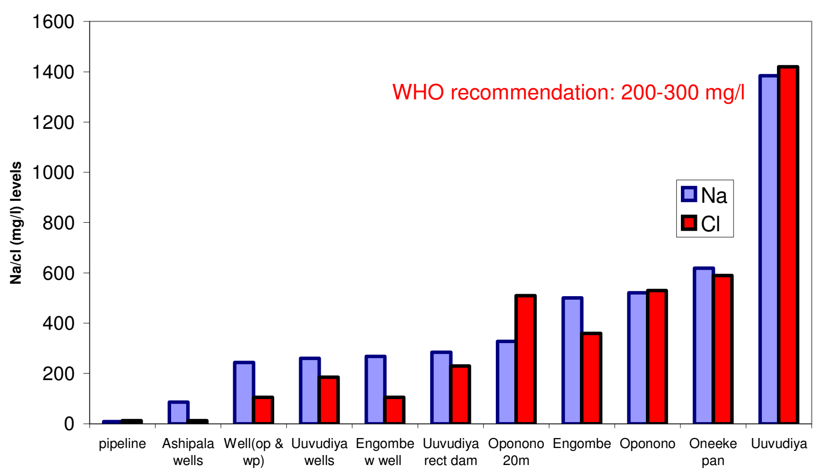
Cattle too, have to travel long distances to the water points. The maximum observed distance that cattle travelled was 6km. This has led to some farmers opting to make their cattle spend a day or two without water. Other farmers move their livestock closer to the water points and other water sources, especially during the dry season when there is very little veld water. This has resulted in limited grass in the vicinity of water sources because of trampling and overgrazing. The situation has encouraged unequal spatial distribution of livestock across the area and has a negative impact on the health of the environment around the water points. This was demonstrated at Lake Oponona in early December when it was vacated by herds of thousands of cattle as soon as it rained. The rainfall meant that water was available elsewhere where grazing had not been overused.

Most sources of water in the area, besides the pipeline and a few deep wells, have water that is too saline to be used for human consumption.



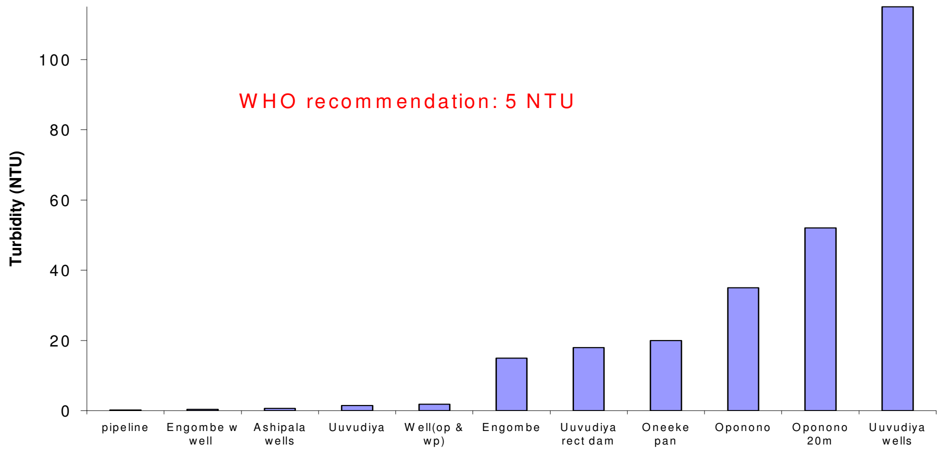
Conductivity in the various water sources

The amount of salt content for each water source was substantiated by the respective amount of Sodium and Chloride ions.



Levels of sodium and chloride in the different water sources

High turbidity is also present in some water sources of the area, including Lake Oponono.



Turbidity levels in the different water sources

Pipeline water is the safest water for drinking, but is expensive for the supplier (the government). In the future, residents may be charged for using pipeline water and therefore people may need to look to other sources of freely available water. The community resented what they considered to be ineffective management by authorities of pipeline water, which includes leaks and broken pipes, and taps and water tanks that remain unrepaired for a long time. This presents another challenge to water management in the area.

Fish production in the Etaka System

Fish in the Etaka system come from the Kunene River via the Cuvelai system and settle in the main water sources such as the excavated dams, lakes and pans. Fishing is both a cash income and of nutritional value to the people's diet.

Fishing regulations have been put in place by the traditional authority with regard to what fishing gear should and should not be used for fishing and the appropriate time of the season to fish. Such regulations have been ignored however, mostly by outsiders. These outsiders are crowding into the lakes with non-traditional commercial fishing gear, including large nets, which adversely affect water quality. They also fish during the time of flooding when, traditionally, there was no fishing allowed in order to preserve the water quality for livestock.

Furthermore, some water bodies can hold water for the whole year, but water becomes muddy as a result of fishing with nets. The disturbance of water by fishing poses a serious concern to the cattle owners and herders, especially those living far from water points, as they have to travel long distances to find alternative sources or dig wells to obtain water for livestock and for themselves.

Livestock and grazing

A herd of cattle walking towards a nearby water source

Large numbers of livestock visited the pipeline water points every day during the time of our observations (January).

Cattle posts in the area have been observed near water sources, which are located in grasslands where grazing and water are available. The areas around the water sources are therefore overgrazed, as livestock tend to concentrate close to the sources.

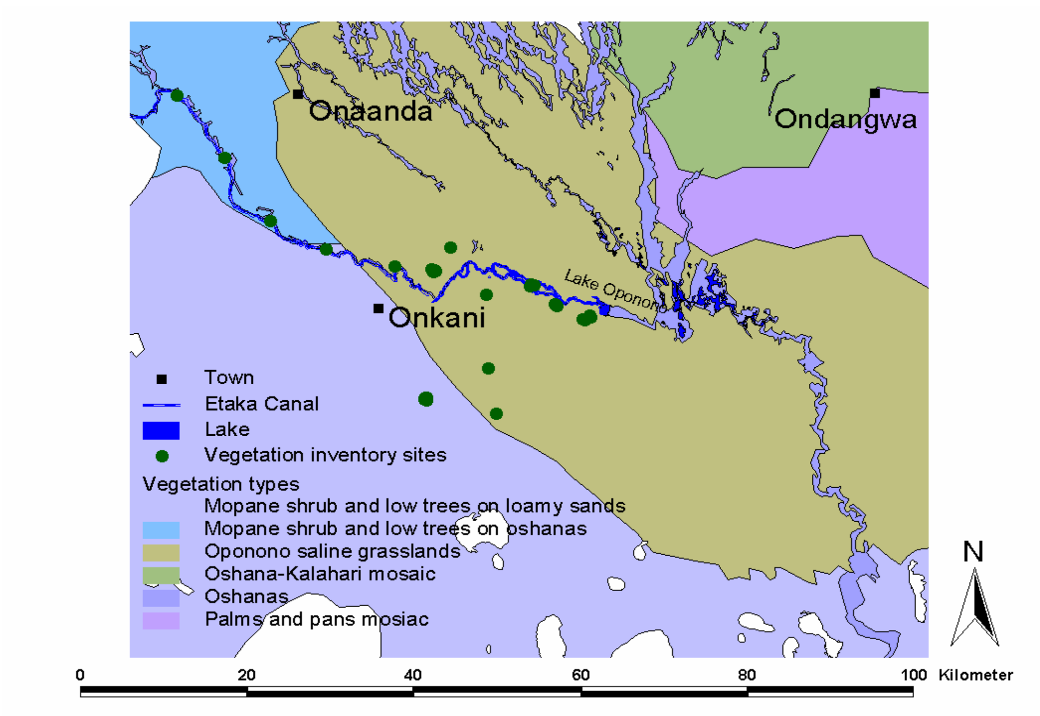
Established households graze livestock in the commons along the Etaka Canal and in the vicinity of their homesteads after harvest, to utilize the crop stalks left in the fields. The western area along the Etaka is particularly heavily overgrazed and is immediately dependent upon the first rain of the season for regeneration. Hence livestock is moved to southern and eastern areas where more grazing is available.

Relatively wealthy farmers possess large herds of livestock. This study observed one farmer with livestock totalling 2 500 cattle, 400 goats and 200 sheep. The same people are largely temporary residents at the cattle posts and have permanent houses elsewhere. When grazing is depleted, they move to new areas. This demonstrates how unequal the distribution of livestock possession is in northern Namibia. Cattle are the dominant livestock in the area, evidenced by the number of cattle posts. However, cattle are the most susceptible of all livestock to drought conditions compared to goats and donkeys.

Vegetation

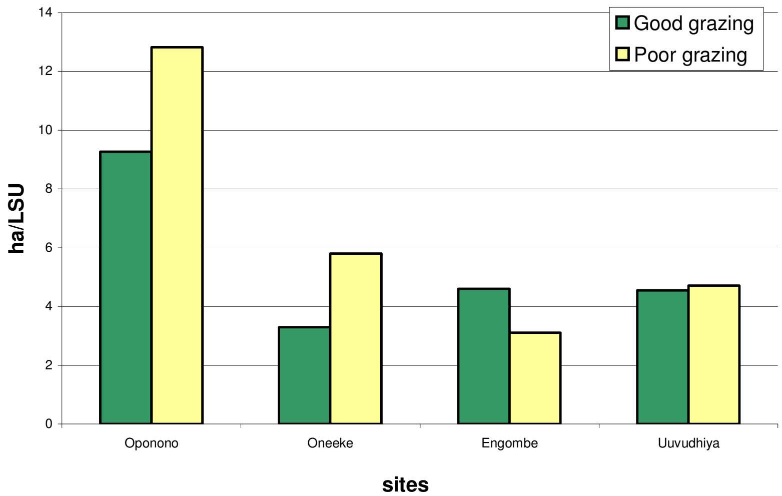
The dominant vegetation types in the study area are Mopane savannah and tree savannah. Four different landscapes have been identified within which the vegetation types mentioned above are found. These are the Cuvelai, Mopane Shrublands, Eastern Kalahari Woodlands, and Salt Pans and surrounding plains.
Mopane, the dominant woody plant in the area, is being used in an unsustainable manner. Alternatives for cooking and building materials, which decrease the amount of wood necessary for domestic use, should be considered to preserve the future of this resource.

Large landmark trees such as Baobab trees are preserved, while palm trees are exploited for a number of uses. Young trees are unable to grow where cattle and goats graze, which is almost everywhere in the area.



Vegetation types and vegetation inventory sites in the study area

Grass found in the Oponono saline grassland is largely unpalatable and therefore does not contribute to the overall carrying capacity of the area.



The carrying capacity (ha/LSU) for good and poor grazing areas at four study sites.

Some of the grass species found in this area indicate the deterioration of the veld in terms of overgrazing and probably soil erosion. The soil types found in the area present other challenges to growing vegetation, such as palatable grass and woody vegetation, as this vegetation does not grow easily in sandy, saline soil.

Conclusion

According to the 2001 census results, 21.4% of Namibia's population live in the regions of Omusati and Oshana with an average population increase of 1.9% per year. Similar to the rest of the region, the population in the Etaka canal area has greatly expanded during the last two decades. People have moved to the area because of available pipeline water and good grazing areas. Today, the population is becoming too large for the area to support and is putting pressure on the natural resource base, including grazing areas and water sources. During our study, we found that existing farms occupied all suitable farming areas for mahangu cropping and people moving to the area had great trouble finding somewhere to settle.

There are numerous environmental challenges that compromise environmental sustainability in the area. Some of these challenges are quite serious and need immediate attention from decision-makers and community members. We discovered evidence of overgrazing, water problems and deforestation, all of which environmental decision-makers should address.

A key question of the study has been: are these environmental challenges contributing to desertification? Desertification, defined as a loss of productivity and land degradation by mismanagement of resources, threatens sustainable development and resource management. Desertification is caused by difficult climatic conditions coupled with human induced changes and impacts in the environment. A variable climate in an arid environment, combined with an increasing population, bringing with it more livestock and a greater need for forest resources, is contributing to great changes in the environmental conditions of the area.

However, as desertification is a human-induced process, humans can lessen, stop or even reverse the process. Actions such as:

- water conservation for household use,
- not polluting water sources or vandalising water points and
- using appropriate fishing techniques all lead to increased sustainability of water resources.
- managing woodland resources in a sustainable manner and
- increasing the reliance on alternative cooking techniques such as tsotso (low fuel-using) stoves, will reduce the effects of deforestation.

There is also a need to greatly reduce dependence on woodland resources for homestead construction by using alternative materials such as clay bricks.

Community Based Natural Resource Management (CBNRM) uses community organisations to set conservation and usage guidelines for area resources. Through awareness-raising and greater community participation in local government and community organisations, people will be more likely to take measures that lead to curbing land degradation. That is, of course, if other options exist.

Finally, this study, although completed in name, is far from over. Government ministries, private organisations, local government and community organisations all need to take an active role in further investigating desertification and most importantly, possible solutions in the area. This study was merely a starting point. Considering that we based our conclusions on a small sample size and one data set, it is difficult to know if our results are representative.

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