SOIL DEPLETION AND FARMING STRATEGIES IN ZOMBODZE

March 2004.

-The Danish university consortium of sustainable Land use and natural resource Management (Sluse)
-Interdisciplinary Land use and Natural resource management

Written by:

Ditte Gundermann, RUC.240274-3246
Freddy Febres, KVL. AD03017
Martin Pihl Jensen, KVL. L10342

Supervisors:
Andreas de Neergaard, Department of Agricultural sciences. KVL
Quentin Gausset, Institute of Anthropology, KU

Abstract

The following report is the result of joint cooperation between Southern African and Danish students in the course Interdisciplinary Land Use and Natural Resource Management . The investigation was conducted during a 3-week field course in the village of Zombodze in southern Swaziland.

The case area of Zombodze is a community of small scale substance farmers, where the farming represents one of the most essential livelihood activities. The objective of this report was to analyse the relation between farming practices and soil degradation.
During the field trip the following factors were identified as main constraints on different farming strategies in Zombodze. Erratic of rainfall, availability of traction and access to farming inputs all affected the productivity and soil conditions. There was a general shortage of phosphorus and nitrogen. There was a positive correlation between application of manure, education of farmers and agricultural production was found. People adopted different coping strategies to overcome the existing constraints.

Introduction

The following report is the result of the collection of data during a three-week field course as part of the SLUSE course *Interdisciplinary Land Use and Natural Resource Management.*
The field trip followed a preparatory course during the fall of 2003, and this report is the conclusion of the course.

Background

About two-thirds of Africans depend on agriculture for their livelihoods, and population in the region continues to grow, forcing farmers to intensify in order to meet the increased demands for food (Henao & Baanante, 1999). The resulting depletion of nutrients from soils has caused crop production to stagnate or decline in many African countries.
In great parts of Sub-Saharan Africa the issue of erosion and soil fertility has been a problem area receiving increased attention. A number of countries are facing problems with loss of nutrients and top soil and policy makers are beginning to address this problem in order to prevent further loss of nutrients and implement protective measures to ensure this. The farmers of these areas also perceive the loss of nutrients from their soils as a major problem, and list soil fertility management as a top priority (Smalling *et al.*, 2002). Many farmers in Southern Africa are struggling with low productive soils and have problems buying farming inputs such as fertilizer and pesticides. The issue of soil fertility is also important in Swaziland, where government and local communities are concerned that the state of the soil is being degraded as top soil and nutrients are lost each year due to erosion.
The majority of the land (74 %) is used for agriculture and 77% of the people in Swaziland live in rural areas (Swaziland Government, 1997). Only app. 11% is used for crop production, the main part being used for grazing land.
Encroachment of land by expansion of settlements is also resulting in decreased grazing area for the livestock, resulting in problems between cattle grazing and crop production. Cattle are forced to graze near fields and roads which leads to problems with crop damage and loss of crops.

But Swaziland faces a number of problems in regards to improving the agricultural production and the conditions of their soils. In general Swaziland suffers from a lack of qualified and experienced experts in the field of agriculture, affecting the development and improvement of soil management strategies (Manyatsi, 2003). Furthermore the majority of the farmers in the rural areas are small-

scale subsistence farming, where farmers are faced with problems in maintaining their livelihoods and lack means to buy farming inputs. In the community of Zombodze farming constitutes one of the major livelihood activities and the people are dependant on the crop production as a source of income and stable food. The degradation of soil fertility is reducing the production potential of the cultivated lands, which furthermore is expanding because of an increased number of homesteads. This threatens sustainable cultivation in the future if the issue is not addressed at this point. However a number of constraints exist in relation to increase productivity and maintain and improve soil fertility in the area, limiting the possibilities of local farmers to actively improve productivity and reduce nutrient losses form their fields.

We want to analyse how the various constraints affect the way cultivation is done and how production and soil fertility is managed in the area, both from a natural and a socio-economic point of view, and understand how the farmers react to these challenges.
In order to obtain this information we pose the following research question:

How does different constraints affect possible farming strategies and thereby productivity and soil conditions in Zombodze?

The following working questions were posed in order to focus the relation between land management practices and the soil fertility:

1) *What type of farming practices are adopted in Zombodze ?*
2) *What constraints do the farmers face in Zombodze?*
3) *What coping strategies do farmers adopt to overcome the different constraints?*
4) *How does the different strategies affect the productivity and soil conditions?*

We have tried to identify some of the major constraints by analyzing different households' cultivation methods and acquiring information about socio-economic factors in different parts of Zombodze community and combining these with analysis of soil samples from the fields of the farmers, we hope to be able to identify some of the major constraints of the farmers. We will also

try to asses what options and coping strategies the farmers who are struggling with many of the above mentioned constraints adopt.
Our original intension was to compare how the different farming strategies influenced the soil fertility from both a chemical/physical and socio-economic aspect.
A number of our original assumptions turned out to not to play the importance originally implied, and new discoveries illuminated the problems related to farming strategies and soil fertility management in a different perspective.
We discovered that the soil conditions varied considerably in the area, and assessing the direct effect on the soil of the different farming practices was hard. The chemical and physical compositions of the soils differed notably in the different areas, and judging what was already inherited in the soil and what was caused by certain farming practices was difficult.
After the first series of interviews, we discovered that most farmers adopted the same practices in relation to cultivation and management of the soil fertility, making a comparison between different strategies difficult from a chemical/biological perspective.
We therefore decided to focus more on what different approaches the farmers had to the constraints they faced and how they perceived their management and possibilities in coping with the situation.

Area description

The community of Zombodze where the fieldwork was carried out is located in between the highveld and middleveld zones at an elevation of 800-1100 m above sea level, in the south-west of the country on the border with South Africa.
There are two seasons, a wet summer from October to March where the main cultivation is done, and a dry winter from April to September where harvest is done. Rainfall is app. 1000-2000 mm although it has been erratic and unreliable the past years. There were severe droughts in 2001 and 2002, decimating yields on non-irrigated land, and 2003 was dominated by late rains, affecting the timing of the crop cultivation. Mean temperature range from 11ºC in winter to 22ºC in summer, and short frosts occur occasionally during winter.
Approximately 6000 people live in the area (Chiefdom), although several may be working outside, mainly in the nearby city of Nhlangano or in South Africa.
Contour ridges were established in some parts of the community by the government in the late sixties as a measure to prevent erosion, and from what we learned, farmers do maintain these grass strips. The homesteads are generally dispersed with no larger clusters separated by cultivation areas,

and the fields are generally located near the homesteads. Each homestead consists of members of the same family, usually housing 5 – 30 people, although not everyone may be living in the homestead permanently. The vegetation is mainly dominated with fields and grazing land and there is a large commercial plantation of black wattle and eucalyptus, which has limited the access to grazing areas for some of the villagers.

The study area was divided into zones in order to facilitate orientation and data collection.

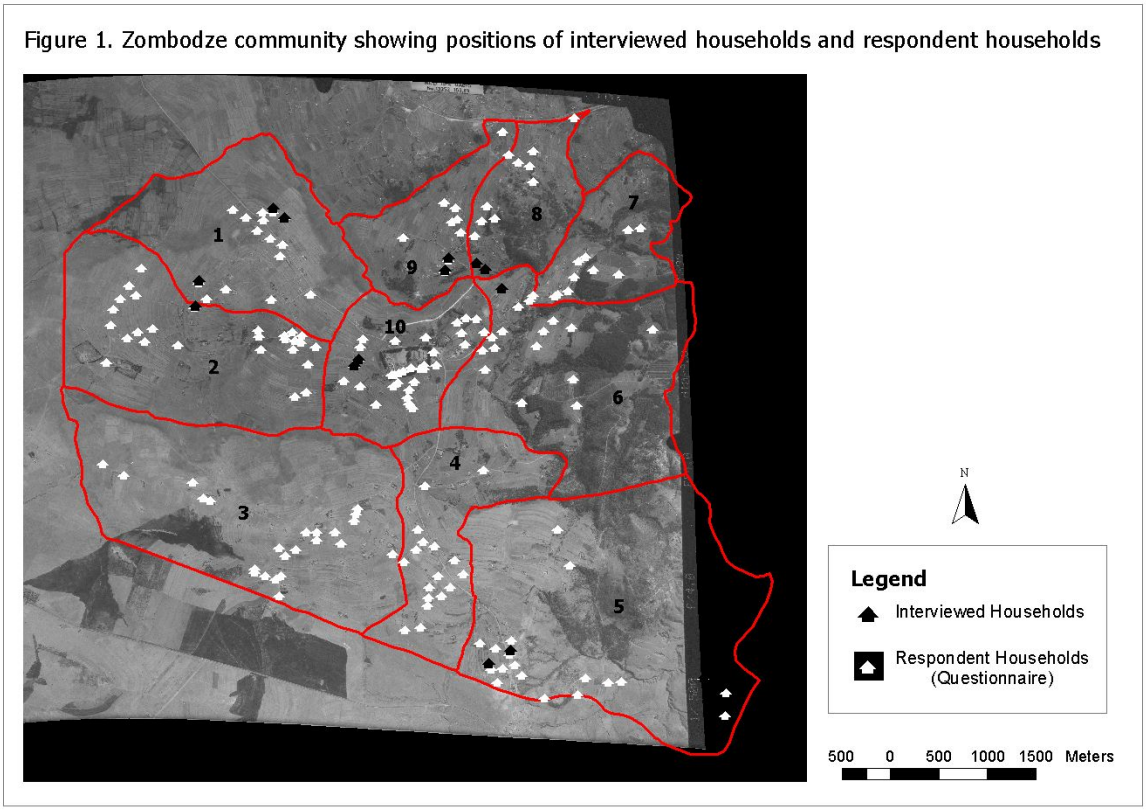

Fig 1. study area and zone demarcation

Methodology

To obtain information about how farming was generally done in Zombodze and what constraints farmers face in the area, we applied both direct observations and social scientific methods, such as questionnaires and semi-structured interviews and PRA techniques. In order to get more specific information about how the farming practices affected the soils we combined these with some natural scientific methods. These were soil testing and erosion measurements that served to tell us

something about the amount of available nutrients in the soils and the degree of erodibility. In the following section we will describe the different methods in more detail and what they were used for.

General questionnaire

Before the field trip all the groups had designed a common questionnaire together, which were answered by members from 220 homesteads in the village. The questions concerned the composition of the homestead, age, profession and educational level of the members, income, sources of water and firewood, farming practices etc. (see appendix). From these questionnaires it was possible to get an overview of the village and select homesteads for further interviews. The information that we used from the questionnaire that we used to stratify homesteads concerned the number of fields, yield, way of ploughing, number of cattle, application of fertilizer and manure, use of irrigation, level of education and number of people in the homestead. We also used the questionnaire to make statistical correlations between these different factors. These correlations were then further investigated through interviews.

Interviews

We made 19 interviews during the 10 days in the village. The interviews were all semi-structured interviews but the first ones were more structured than the latest. They were conducted using an interview guide (see appendix) with prepared topics for discussion. As we got more familiar with the techniques we found that the interviews became more impulsive with open ended questions inspired by the conversation, and we moved further away form the prepared interview guide method. We found that very successful since the informants were allowed much more freedom in answering and the information were more detailed.

14 of the interviews were with different farmers. The farmers had been chosen from the questionnaire data based on different factors as mentioned above. We stratified from visual spatial topographical differences and chose two areas with seemingly different inherent soil characteristics. We then tried to pick farmers within these areas with different economic status, varying productions and who ploughed with different means. The interviews then concerned the farming practices and coping strategies and the prices of input.

We made 2 interviews with extension officers, one with the agricultural extension officer, and one with a veterinary extension officer. From these interviews we got information on the most common farming practices, the recommended farming practices and the previous and present number of cattle in the village etc. Besides that we made a number of interviews with our interpreters concerning the correlations from the questionnaires to get an idea of the causes and validity of the correlations.

PRA

Besides the individual interviews we also made two PRA sessions with groups of farmers. We again chose farmers with different economic status in terms of ownership of cattle and tractors. The sessions included the making of a seasonal calendar of farming activities and a ranking of importance of different farming activities. The idea was to get the farmers to discuss their farming practices, constraints and coping strategies with each other. For some reasons that will be described later, these sessions were not very successful and we did not exactly get the information we had hoped for.

Observations

Visual indicators like the colour of the soil and crops and the height of plants were used to give an idea of the general condition of the soils and crops. Topography and apparent signs of erosion were noted and used in the stratification of farmers for the interviews as mentioned before.

Soil testing

The nutrient content of the soils were analysed through soil tests. Some of these were carried out in the village, some in Manzini and others were carried out at KVL in Denmark. We used a qualitative method for investigating the erodebility of the soil. This was done by digging some gutters in the fields perpendicular to the slope. After it had rained the collected soil was removed from the gutters and weighed. The results were used to analyse the correlation between farming strategies and soil fertility.

Area measurements

Approximate area measurements were made on some fields to get the yield per square meter and the applied amount of fertilizer per square meter. This was done to compare the outcome per input of the field. The area measurements were made by transects walking.

Methodological considerations

As the project came underway, a number of the methods adapted for our data collection were modified as our knowledge and perception of the area changed.

The general questionnaire proved to include some problems in relation to some of the specific quantitative aspects like the size of the farmers fields, the amount of manure applied etc. Some of the questions were not clearly formulated and a general consensus among the student/groups members about how they should be asked was not obtained. This resulted in parts of the questionnaire having to be omitted. Part of the reason was probably also that the questionnaire had not been tested prior to the field trip.

After completing the general questionnaire we had some quantitative information about the village. The interview questions therefore focused on more qualitative information about farming practices and perceptions. As described earlier however many of the first interviews were quite focused on specific questions from our interview guide, and thus of a more quantitative nature. This made a number of the interview sessions quite stiff and somewhat boring for the farmers, and we realized that the information we obtained did not tell us much about the reasons for their choice of strategies. It also turned out that we conducted the interviews differently within the group, giving different types of information, which was then difficult to compare.

After the first few days we had an overall idea about how the farmers cultivated their fields and what the major constraints were, so the questions posed in the interviews towards the end of the field trip where more analytical, regarding what coping strategies people adopted if the harvest failed and what their perceptions about their soils and fertility and general area were. We also started to make the interviews more flexible and actively going into the fields of the farmers, observing how their crops were doing and from there asking what they did and why.

PRA sessions

For our first session we had invited 5 farmers/families, but as the place we hosted the session was the common meeting place, around 25 people turned up, making it difficult for our interpreter to clearly communicate our intensions, and making it difficult for us to know who were the invited

farmers and who had just turned up. We also realized that our individual roles in the session were not clear, leading to confusion once the session was underway both for us and for the farmers. We had discussed a possible ranking exercise with our interpreter, who advised us not to undertake it, as he thought the farmers wouldn't understand the meaning of the exercise. The exercise failed to work according to what was planned, but we got more information about the interaction and importance of all of the various farming activities in the cultivation calendar.
For our second session only 5 invited farmers were present and our cropping calendar which also had failed in the first session worked. At the end of the session some more open ended questions opened up a bit of discussion which was the main focus of the session. However the first part, creating a seasonal calendar took up most of the time, leaving us with less time for discussion. Generally we learned a lot in respect to the problems involved in using these techniques.

Soil tests

The amount of time spent on soil testing with the small test kits in the community hall took up a large portion of the second week, far more than we had planned for. As the main soil analysis was going to take place back in the laboratory, we could probably have conducted most of our analysis there and used the time in the field more efficient. The results obtained in the field were not directly incorporated into the presentation given in Manzini, so the most efficient use of the time would probably have been to conduct all of the test back at the lab in Denmark. However, working with soil samples under field conditions and trying to obtain useful results to incorporate in our stratification was a method we wanted to try and which gave a good idea of the difficulties involved with this.

Ill.1 Digging in gutters

Ill.2 Soil tests

Generally we had some difficulties within our group, which led to difficulties in conducting the data collection. We were 8 people from very different backgrounds and 4 different cultural settings. The Southern African students had received our synopsis only shortly before we arrived in Swaziland, and. During the preparations in Manzini we all agreed upon the main objectives and how to obtain the necessary information, based mostly on the synopsis. Nevertheless we experienced fragmentation and a sense that nobody had a clear idea about what information we needed and how to obtain it when we were out in the field. This resulted in loss of valuable time in the field, and we had big difficulties in getting people together for group discussions, which made it very difficult to make decisions on what do.
During the field trip, it became apparent that some of the southern African group members felt that the Danish group had already decided the objective and how to obtain the information, and therefore felt left out of the decision making processes. This was clearly reflected in the motivation of some of the group members. The two major problems in relation to this was first and foremost the preparatory process, which we already were aware of. Secondly the number of people in the group was too much.

Findings and discussion

To understand the constraints that farmers in Zombodze experience and the coping strategies they adopt to overcome these constraints, we wanted to know first the common farming practices and the activities that is connected to the different seasons.

Farming practices

As we decided to focus on maize being the main crop produced in the area, the cultivation practices of other crops has not been examined and analysed.

From our PRA sessions, and based on most of our interviews, we tried to get an overview of the type of farming practices adopted in Zombodze.
We discovered that most of the farmers actually cultivated their lands in a rather similar manner, all being subject to the same natural conditions but with different social and economic situations.

The most common practice was to cultivate maize, sometimes together with a secondary crop, usually pumpkins or beans. The largest part of the households we interviewed produced mainly for their own consumption. Those who had a surplus production sold the maize either to neighbours or in Nhlangano. In some cases farmers had given away surplus to other farmers for whom the harvest had failed. However the nature of the agricultural production in the community is subsistence farming.

We compiled a seasonal calendar, based on the PRA sessions and it seemed to fit well with what we learned through the interviews and through observations. The timing of the different activities varied amongst farmers, as it depended on accessibility to inputs and weather conditions. We did a standardized calendar for the normal time of the different cultivation activities (see fig. xx) and also asked when the farmers had performed the different activities this year, in order to identify seasonal constraints.

Phase	**Period**	**Description**
Land Preparation	July – August	Ploughing under of crop residues to provide green mulch and reduce weed spread.
Ploughing & Planting	September–November	If this period is missed conditions for growth become less favourable; basal fertiliser is applied during this phase;
Weeding, Topdressing & Pest Control	January – February	top dressing with fertilizer
Harvesting	April-May	dried out in maize crib; shelled; stored in maize tank
Selling	July – August	dependent on time of planting

Fig 2 seasonal calendar

The ploughing and planting is done by means of tractors or oxen, though planting is also done by hand. Of the farmers we spoke to, very few ploughed under their crop residues, as they explained that it is hard and time consuming. Farmers who apply manure does that either just before ploughing by spreading a layer over the ground, or mixed with the seed while planting. Chemical fertilizer is common and applied in two steps, during planting and when the crops are knee high. Many farmers cultivate one of many different hybrid varieties of maize, but local types are also common. Weeding is done by hand with a hoe and is the most labour intensive part of the cultivation. It is usually done by family members, but some farmers also hire labour to do the weeding. Irrigation is practically never used for maize, but in some cases for vegetable gardens.

The production potential of the area according to the extension officer is 6000 kg maize/ Ha, and he explained that the production in the area ranges from app. 1000-5500 kg/Ha. From our interviews we found an average production of app. 1000 kg/Ha.

Main constraints

In Zombodze some farmers have more means than others, but the general situation is that most farmers lack money for inputs in varying degrees. Furthermore most farmers are affected by climatic conditions like lack of rain or heavy rain and physical conditions like soil erosion. The following section presents the main constraints that we came across.

Traction

It was mentioned repeatedly by farmers both in interviews and PRA sessions, that the accessibility to mechanical traction at the right time is crucial to the cultivation of the area. Different factors affect the accessibility to traction and thereby the production of crops.

As we discovered from the analysis of the data from the general questionnaire, the majority of the farmers (88%) use tractors for ploughing their fields. Figure 3 shows that out of the farmers who answered the questionnaire only 10% use their own tractor for ploughing, and the majority of the

farmers (78%) are dependent on renting a tractor.

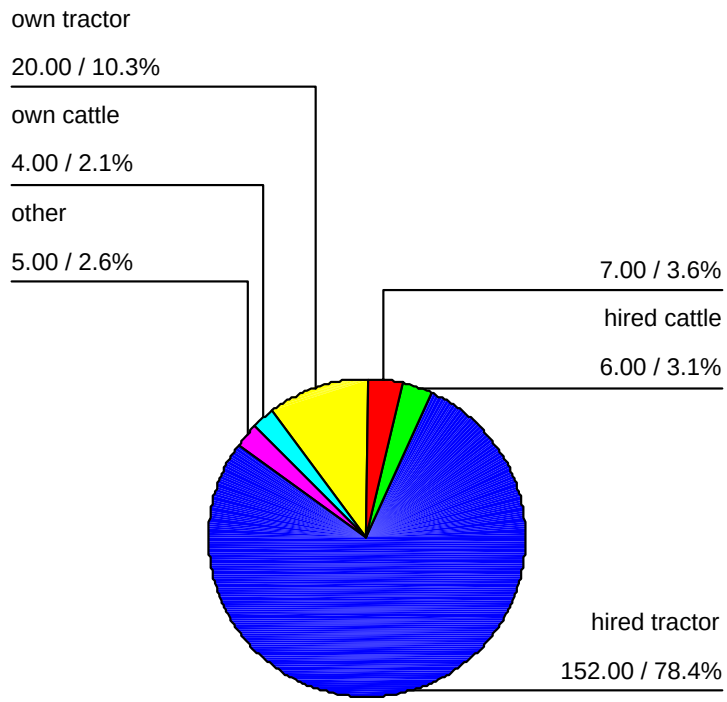

Fig 3. Distribution of different ploughing techniques. Green = no answer.

According to the extension officer there are to possibilities for renting a tractor, either from a government agency or a privately owned tractor from another farmer in the community. Of all the farmers we interviewed no one used the government tractors. The reasons for this were first of all the price and the waiting time. The price of both government tractors and private tractors are 120-150 Rand/hour, but according to the extension officer, the government agency charges from the moment the tractor leaves the garage till it arrives again. This makes the government tractors very expensive. Another problem with the government tractors according to farmers was the long waiting time caused by the limited number of tractors. Farmers also stated that the service was inefficient and unreliable and one woman said that the government agency would not sent tractors to her field because it was to small.

Since only 10 % of the farmers from the questionnaire own a tractor, the privately owned tractors are also limited in numbers. Farmers who rent traction are therefore affected by waiting time. The

main constraint mentioned by almost all farmers was the waiting time for ploughing since this affects the planting time and thereby the growing period and the yield.

In order to rent a tractor farmers have to have capital. One tractor owner stated that the sooner the money was paid, the faster the service could be achieved. There did not seem to be any credit arrangements between the farmers and tractor owners or agreements about who gets ploughed first, so the result was that the farmers with the most insecure income was often the last to have their fields ploughed. Furthermore it could be hypothesised that tractor owners might be more inclined to plough for farmers with large fields before farmers with small fields because it pays more, thus also leaving the poorest farmers last in line.

It takes approximately 4 hours to plough an average field with a tractor, amounting to 450- 600 Rand. Traction thus is a big expense for most farmers compared to expenses for fertilizer and seed and is therefore a major constraint. It has however high priority for farmers, and though they claimed at the PRA session that all activities in the cultivation cycle are equally important, it was clear that ploughing was determinant for the initiation of the crops and thereby the outcome.

Figure 3 also shows that a very small number (5, 2 %) of farmers use animal traction. Compared to the percentage of farmers who own cattle (46 %), this is surprisingly low.

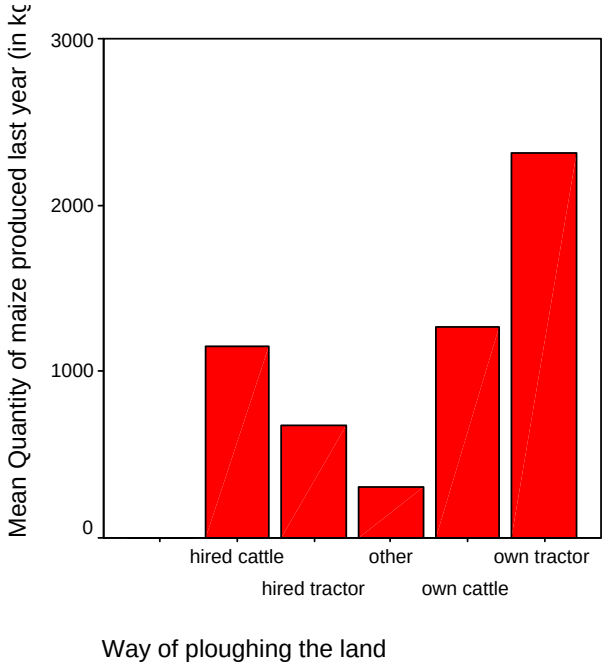

Fig 4. Average production ploughing technique.

From interviews we found out that explanations could be that ploughing with oxen was very slow and laborious and that larger fields therefore were relatively easier to plough with tractors. One farmer also told that ploughing with oxen is less effectful as it cannot plough as deep.

The data from SPSS show correlation between different means of ploughing and production as can be seen on figure 4. Tractor owners produce more than farmers who rent tractors and farmers who use oxen. This also indicates that the access to traction is crucial to the outcome of the crops. The reason for the higher yield is probably also that tractor owners are generally wealthier, and have more means to acquire inputs like fertilizer, pest control and improved types of maize. This is supported by the fact that tractor owners earn an extra income by renting out their tractor services. In addition SPSS data show that tractor owners also own more cattle than other farmers. They therefore have the possibility to apply manure, and as will be described later, application of manure might have a positive effect on the production.

According to figure 4 farmers who use oxen for ploughing have higher yields than farmers who hire tractors. This is somehow surprising since so few farmers, for reasons stated above, use oxen for ploughing. It could be that farmers who use their own cattle plough and plant before farmers who rent tractors, but since the number of farmers who use oxen for traction is so small, the statistical significance is too small to draw any conclusions. It seems unlikely that farmers would pay relatively much for hiring a tractor when they could get higher yields by ploughing with oxen instead. However these correlations should be interpreted somewhat with caution, as the percentage of farmers who hire traction also includes a small number of farmers who have a large production, but because of the large percent of farmers with low production the production average of this group is low.

Fertilizer/Manure

Contrary to what we had expected most of the farmers we interviewed responded that they used chemical fertilizers, though only to the extend they could afford. Almost everybody perceived fertilizer as one of the most important inputs and would apply more if they could afford it. However during our second group interview/PRA session one small group of farmers pointed out that the soil seemed to loose it’s fertility the more fertilizer was applied. According to the farmers the soil gets

“addicted” to fertilizer and require an increasing amount in order to maintain the fertility. From our PRA session we got the impression that application of manure did not seem to cause the same problem.

The amount of chemical fertilizer applied varied from farmer to farmer, and when asked farmers said that they knew from experience how much to apply. According to the extension officer the appropriate amount of fertilizer to apply is approximately 500 kg (3:2:3 22, NPK) per Ha and it is also recommended to apply lime to the soil. The average applied amount of fertilizer among the farmers we interviewed is approximately about 390 kg/Ha. None of these farmers we interviewed had had any guidance from the extension officer on appropriate application of fertilizer. It is our perception though, that it was not lack of knowledge that prevented the farmers to apply more fertilizer or lime, but rather lack of money.

The data obtained from the questionnaire showed an interesting correlation between households who applied manure on their fields and the total production of maize, being almost double for those applying manure. The same correlation showed that the increase in productivity was obtained using the same amount of fertilizer as the farmers who didn’t apply kraal manure. This indicates that the increase in production did not originate from application of fertilizer.

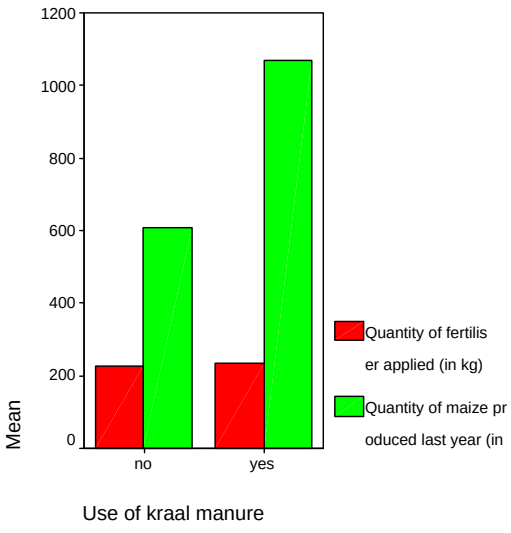

Fig 5. Average of different forms of fertilizer and production.

As we did not perform a nutrient analysis on the krall manure, and we do not know how much manure the individual farmers apply it is difficult to estimate the effect it has on the soil and crops.

We suspect that the nutrient value of the manure is not high since the livestock feed on local pastures which are very scarce, especially in the ploughing and planting season in Sept/Oct. after 8 months without rain. According to the extension officer it requires a layer of manure of 20-25 cm to supply the soil with enough nutrients. From what farmers told us they do not apply close to this amount, so it seems questionable that the manure should have such a great influence on the production.
Part of this explanation could be linked to the correlation between number of cattle and production, which is described in the section about traction. From the questionnaire we found that 74 % of the farmers who own cattle apply manure, and only 33% of the farmers who don't own cattle apply manure. The explanation is probably a result of many interactions but we believe that the manure must have some influence on the soil though probably not as much as the SPSS data indicate. Since 56 % of the farmers in the area do not own cattle, it will be more difficult for these farmers to obtain the same productivity as the farmers who own cattle.

Some of the interviewed farmers who owned cattle showed us and explained that they either spread the manure evenly over the entire field (resulting in a very thin layer of manure which we presume doesn't contribute much nutrients to the soil) or apply the manure together with the seed during sowing (thus minimizing waste). The method of application of manure thus could indicate that some farmers have agronomical knowledge about the efficiency of the different ways of applying it.

It should be noted that some of the data from the questionnaire can be questioned as to the interpretation, as stated in the section xx.
The information on manure applied to the fields did not include an estimate of the quantities applied, making it difficult to draw decisive conclusions on the direct effect of applying manure on the productivity of the land. Another problematic thing concerning the data obtained from the questionnaire is the fact that the field area was given in number of fields, but as we discovered that farmers had different ways of classifying 'a field', and the size of the fields varied a lot. This made it hard to estimate the output per hectare, and thus draw decisive conclusions upon how the different farming strategies affected the productivity. Another methodological consideration that our interpreters brought to our attention is that the local word for cow manure and fertilizer is the same. Some confusion in collecting data from the questionnaires could thus have arised, but during our

interviews our interpreters made it clear for the farmers what we meant when we talked about manure and fertilizer respectively.

Knowledge/perceptions

Analysing the data from the questionnaires we discovered that farmers who have higher education (from high school and up) are more productive than farmers with low education (grade school). On figure 6 it can be seen that the increase in applied fertilizer does not follow the increase in production, suggesting that their output/input is higher than for the farmers with lower education.

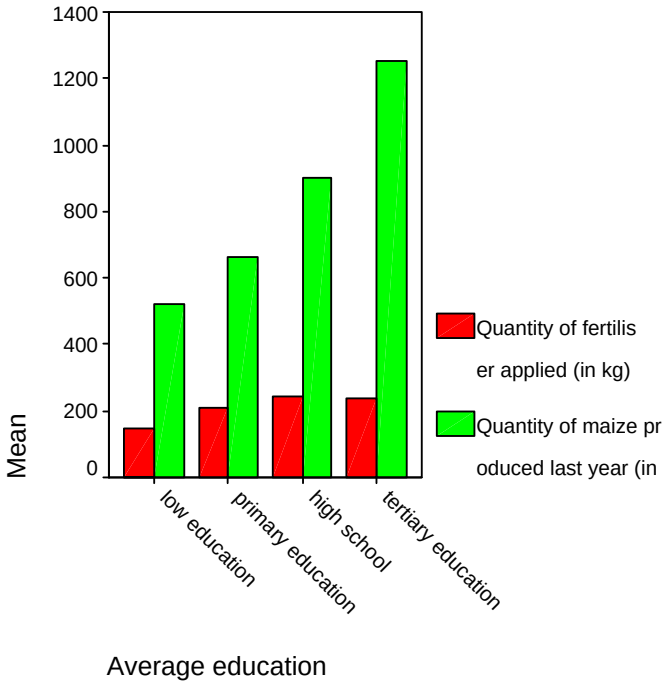

Fig.6: level of education and production

Through interviews with our interpreters we found out that most of the farmers who have higher education learn about farming techniques in high school. The reason for the higher production could therefore be that educated farmers know more about field management. According to our translators educated people besides have access to well paid jobs, giving them the opportunity to buy more farming inputs than farmers with low education. The SPSS data also shows that there is a positive correlation between level of education and application of manure. The reason could be that educated farmers apply manure in order to increases the production.

We learned from interviews that the price of school fees is a major expense for most of the poor farmers in the area, and therefore also restricts the access to education for the most marginalized farmers.

Another source of knowledge is the extension officer in the village. However most farmers responded that they either hadn't heard about him, or that they weren't invited to the meetings held. When we asked the extension officer he responded that he called meetings regularly, but that many farmers didn't bother to come and those who came didn't follow all his advice. The reason for this could be that many farmers cannot afford to follow the guidelines.

Many of the farmers interviewed said that they had gained their farming knowledge through experience, and many showed in-depth knowledge concerning the fertility of their soils and how the ideal management should be, but most as previously mentioned lacked the funds to do so.
In one case a farmer told us that he got the knowledge about the quantities of fertilizer to be applied, the seed varieties to be planted etc. from the companies who sell the goods.

Farmers perceive the erosion in the area to be increasing, and many points at the grazing of the cattle as a reason for this. The perception is however that the overall productivity of the area has increased during the past 10 years. This is mainly due to the increased use of chemical fertilizer and new hybrid maize varieties, which are considered to be very important for the productivity of the fields.

Cattle

Many of the interviewed farmers mentioned that they had some problems of cattle eating of their crops from time to time because most could not afford fences. But the general situation was that the cattle was grazing mainly in some areas away from most fields and the issue of cattle eating the crops was only a small problem though with some variations between farmers.
Another issue related to cattle is overgrazing of the uncultivated grazing area. The area of the grazing lands had decreased over the last 10 years, and the cattle number had actually increased slightly, from 2022 in 2001 to 2134 in 2004 according to the extension officer. According to the veterinary officer, farmers and our interpreters one of the reasons for the decreasing area for grazing was an increasing number of new settlements, increased cropping, as well as the privatization of the plantation. The new owner of the plantation does not allow cattle to graze in or to pass through the

plantation like previously. We discovered that the reasons for keeping livestock, apart from for farming uses and food production, were cultural and economic. Livestock serve as an investment and payment for different cultural transactions. The prize of a cow is 1000 rand and cattle can be used to pay for inputs like fertilizer or traction if there are no other income possibilities. Farmers without cattle do not have this possibility to sell livestock to release cash and are therefore dependent on other income activities.

Rainfall

One of the major natural constraints of the area was the erratic rains, falling only during summer (from September till February).

The time of the rains determine the time of ploughing, as the ground is to hard to plough if it hasn't received any rain. If the rain starts late the planting is delayed and the growing season for the crops is reduced. This year (2003-2004) the rains came in Dec-Jan, and many of the farmers we visited told us they had planted some of their crops late, as mentioned before. Through observations (see ill.3) and from asking the farmers, it was clear that the crops planted late had a poorer development due to a reduced growing period. From the data in SPSS, we found out that the majority of the farmers in the area do not use irrigation. From interviews we also discovered that those who have access to irrigation mainly use it for their vegetable gardens, as these are perceived to be more profitable.

This means that the maize production is dependant solely on rainwater, making it very sensitive to droughts.

Ill. 3. Consequences of late planting

Heavy rains or hailstorms are also a problem, as crops that aren't properly established could be damaged. Two much rain in connection with low infiltration can cause water logging, and this was also a problem in some areas causing the crops to rot.

In some years, 2001-2002, the area experienced droughts. From the analysis of another group in the area (the water-project group), app. 50 % of the households lived more than 200 m away from a water collection point, making the transportation of water difficult on a larger scale. One innovative farmer had constructed an irrigation system, collecting water from the nearby river, and he told us that the rains did not dictate the time he decided to plough and plant his fields. He also had a relatively high production both of maize and vegetables, and practiced crop rotation as fertility conservation.

Soil conditions

The physical condition of the soil is very decisive for the possibility for cultivation. Soil structure and texture determines for instance how easy the soil can be ploughed and the ability of the soil to retain water. The soil structure is connected to texture, cultivation practice and the amount of organic matter in the soil. The latter can be altered through applying manure or ploughing down crop residues and can therefore be different from one field to another within the same area

depending on the cultivation history of the soil. The soil texture is a result of the geological history and cannot as easily be altered. In an area the soil texture can vary but neighboring fields will have similar soil texture.

In Zombodze the soil texture and structure varied largely from zone to zone resulting in a big difference both in water retention capacities and water infiltration rates. In zone 5 the soil is coarse and with very little organic matter. Huge areas with eroded gullies are present and farmers complain about the general soil erosion from the fields.

Ill.4. Gullies zone 5

Ill.5. Sings of run-off

From the stated size of production and amount of fertilizer applied by 6 of the interviewed farmers, we calculated the nutrient balances for N, P and K in for two scenarios. One where all biomass was removed from the field, and one where the plant residues were incorporated into the soil again. The results can be seen in appendix B. The scenario where all the plant is removed showed a net removal of N in 5 out of 6 cases and K in 4 out of 6 cases. There was only a net outflow of P in two cases. All the farmers we spoke to said that cattle were allowed to feed on the residues, so the last scenario is probably closest to the situation in Zombodze. The values of nutrient cycle of maize production have been taken from literature on tropic soils (Paliwal et al.).

The soil analysis gave us some quantitative information about the nutrient contents in the soils which can be compared to the above calculations and the way the different soils are managed.

The percentage of organic nitrogen in the soil samples was very low in all the samples as compared to values from the literature (Neff, J. C. et al, 2002)**.** This corresponds well with our calculations. The P level was almost constant and very low in all the samples which does not fit with our calculation. A possible explanation to this could be that the calculations are made using values from literature describing tropical soils in general, and the local soil and plants could vary considerably from these values. It is known that many of the soils on the African continent are very low, and are loosing nutrients every year (Henao & Baanante, 1999). Based on the samples and the general information obtained about the fertility of the soils and their productivity, this is probably also the case in the Zombodze area.

Considering that the average application of fertilizer by the interviewed farmers (app. 390 kg per Ha) were significantly below the recommended amount by the extension officer (500 kg per Ha), the low nutrient values fits well with what could be expected. The fact that farmers allow cattle to feed on the residues might also have a negative influence on the nutrient balance of the soils, though it is believed by farmers that the manure left by the cattle makes a positive contribution of nutrients and organic matter to the soil. It is however questionable that the amount of manure left by the livestock makes any significant difference. This is supported by the measured percentages of organic material in the samples. Although it ranged from low to high according to the table values, it did not have any correlation with the application of manure**.** This could however be explained by the fact that the quantification of the applied manure was difficult to estimate, as previously mentioned. Secondly the soils in the various zones of the area could have an inherent difference in composition. This was confirmed by farmers and we also observed that the soil in the South East zone bordering with S.A appeared to be sandy and dry compared with the soils near the centre of the village. Nevertheless there were no connections between amounts of organic matter and zone number either.

The pH range of the soil samples varied from 4, 8 as the lowest to 7, 5 as the highest. According to the literature the optimal range for growing maize is between 6 - 6, 5 (Glendinning, et al 1999), and most of the soils are within the range 5, 5 – 6, 5. This means that there were no apparent problems

with Al toxicity (which becomes a problem at pH levels below 4) as could be expected. The application of lime, which the extension officer recommended the farmers, does then not seem a major necessity for the area.

The infiltration rates shows the soils ability to absorb water, thus low rates indicate a low ability to absorb water and a greater risk for runoff on the soil surface causing erosion. The measurements we conducted showed an infiltration rate in the uncultivated fields in Zone 5 100 times higher than the adjacent cultivated field. This clearly indicates, as is commonly known, that land cultivation, turnover of soil and leaving land bare, increases the chances of topsoil runoff and erosion. We also found clear signs of runoff on the cultivated field, compared with the uncultivated field. We also conducted infiltration measurements in another area, however the measurements should be interpreted with somewhat caution, as they were made shortly after a major rainfall, and the ground could have been water saturated. Comparison between the two areas is therefore also difficult.

The gutter samples showed little variation in the contents of run off material, although they were placed in different zones of the area. An explanation for this could be that the brim of the gutter did not fit tight with the edge of the hole, leaving a little space between the gutter hole and the gutter where run off could have washed down. Another possible source of error was the difference in how long the gutters had been in the ground, as some were dug in the following day a heavy rainfall. The method of gutter sampling depended on heavy rains to carry top soil runoff down into the gutters, and was in theory dependant on heavy rainfall. It was therefore not a method that would guarantee a useful result, as we did not know if it would rain sufficiently. However we decided to try our luck, in case a heavy rain would come.

The precise values of all soil tests can be seen in appendix C.

Other issues

The interaction between livestock and crop production did not seem to entail as large a problem as we had expected. Our initial assumption that cattle invading the fields in an uncontrolled manner might be a constraint turned out to be false. Our initial assumption about the village chief announcing the time when the growing cycle is over and the farmers can release their cattle to graze

in the fields, did not seem to correspond with what we learned in one of the PRA sessions. The farmers explained that the release of the cattle onto the fields is an agreement between a group of neighbours depending on when the individual farmers harvest, and chief announces when the cattle must be taken away from the fields.

Labour

Another issue that turned out not to be as big a problem as expected was access to labour. Only very few and successful farmers hire labour (traction) for activities like weeding, planting and harvesting. Most farmers use relatives from the homestead for these activities (maybe this should be described in the description of farming activities). Data from SPSS showed no clear correlation between number of people in the homestead and production, and farmers did not mention lack of labour as a constraint. Nevertheless a few homesteads, mainly in cases where the male head of the homestead was either dead, working outside the community or living in another homestead with another wife, did seem to be affected by lack of labour.

Land tenure

Land tenure as well turned out to be no constraint. Because the land is owned by the king and administrated by the chief we expected farmers to feel insecure of their land rights, but no farmers expressed concern about this issue. Farmers do feel secure and land is past on from one family member to the other and rented out without interference from the chief. An interesting finding was that SPSS showed a correlation between the source of land and production. Farmers who cultivate rented fields have higher production than the others (show bar chart). According to some of our interpreters the explanation is connected to the fact that rented fields are often managed as share cropping where the owner lets another farmer cultivate their land in return for some of the outcome. Farmers who rent fields can afford it and are farmers with some means. In order to make it worth the effort the outcome have to be of a certain size since some of it has to be given to the owner. Rented fields are therefore cultivated more intensively. From the owners point of view share cropping can be a source of some insecurity though since the owner has no control of the cultivation process and outcome. In one case an old woman rented out her field to the neighbour in return of the outcome of a certain part of the field. When looking at the field it was obvious that the crops on her part of the field was doing worse than the crops on the rest of the fields. The woman suspected that the neighbour did not apply the same amount of fertilizer to her part as to his own but could not

do anything about it since the neighbour refused and she was dependent on him to cultivate the field.

Coping strategies

To overcome the different constrains that makes the cultivation of maize in Zombodze difficult, the farmers have adopted different strategies to assure their crop production.

One of the strategies we encountered was crop sharing, which typically consisted of an agreement between a farmer renting part of his fields to another farmers who then cultivate it. The yield is then subsequently shared between landowner and land tenant, in a proportion agreed between the two. Some farmers are forced to adopt this strategy because of lack of capital to buy necessary inputs (chemical fertilizer, seeds, herbicides, etc), and to be able to rent mechanical necessaries as tractors. In one case an old woman rented out her field to the neighbour in return of the outcome of a certain part of the field. Looking at the field it was obvious that the crops on her part of the field was doing worse than the crops on the rest of the fields. The woman suspected that the neighbour did not apply the same amount of fertilizer to her part as to his own. The neighbour denied this and the woman, who was dependant on his help, had no other alternative if she wanted her fields cultivated. For some of the farmers with very few means this could be one solution for overcoming the different constraints. When we looked at the data from SPSS, we found a somewhat ambiguous correlation, showing that the productivity was higher on rented than owned land. This does not fit well with the findings we got from interviews and observations, but our interpreters said that a possible explanation could be that people who rent land have means to invest in both inputs and traction. However the data from SPSS was derived from the questionnaire, and it is possible that the question regarding land ownership has been posed in different ways by the various students, and the answers could then have been understood differently by the villagers. We assume however that most of the farmers who practiced sharecropping were relatively poor, and used it as a mean of surviving.

Another coping strategy adopted for the farmers in Zombodze is the use of different varieties of maize. There are in general two kinds of seeds used; the hybrid and the local variety.
One of the advantages of the hybrid variety is a shorter growth period, and higher yields. The local variety was considered to be more drought resistant, and also cost less. Some farmers told us that the use a mix of both hybrid and local seeds in order to spread the risk of rain failure. Most farmers

said that the hybrid varieties required more fertiliser and water, and were therefore restricted in the use of hybrid seeds, as they could not afford to buy the extra inputs required. One farmer told us that he usually planted the hybrid seeds in the field adjacent to the house and near the krall, and the fields he owned further away were planted with local seeds. He said he did this to protect the hybrid crops, having better opportunities for applying manure and keeping grazing cattle away.
The insecurity of water availability (rainfall) also lead some farmers to cultivate only parts, or some of their fields and leave the others fallow. This was done to save traction and inputs. We observed a large number of fields that had not been cultivated for many years in zone 5, and when we asked the farmers why they did not cultivate these, they responded that they did not have the means to do so.

After the first interviews it became clear that most of the farmers in the area actually invest more capital in their fields than they are getting out in terms of money. This means that in most cases the farmers in the area had some alternative source of income generating activity. The extra income was generated from different types of activities, such as teaching, renting out pick up trucks, domestic crafts as grass mats fabrication and labour, especially during weeding and harvest seasons. However it was difficult to estimate the exact income of the different households, as information regarding money was sensitive. When we asked more in depth about where the farmers got money to buy the inputs they were applying, some told us how they got the capital, but never how much.
To some of the farmers agriculture did not play the most important role, as they either had another occupation, or had relatives who send money from outside the area. One farmer said that if she hypothetically had 1000 rand she would buy other things than farming inputs, school uniforms for the children, things for the house etc., before anything related to farming.

Conclusions and perspectives

The objective of trying to clearly categorize the main constraints for the farmers in Zombodze in natural and socio-economic categories was somewhat difficult, as we found out that they were connected and affected each other in many ways.

One major factor that affected almost all the farmers interviewed was the erratic rainfall, which determined the time the cultivation process could begin as well as the development of the crops

during the growth cycle. Since very few of the farmers had access to irrigation, the rain constituted the only source of water available for the crops. This uncertainty was one factor that could lead farmers to cultivate only some of their fields, in order to minimize eventual losses of inputs if the rain came late or was inadequate. Another strategy some farmers adopted to overcome the uncertainty of rainfall, was the use of different types of seeds, such as hybrid varieties mixed with local seeds.

It was clear that one of the major constraints was the accessibility to mechanized traction, as this was a major limitation to many of the farmers we spoke to in terms of capital expenditure and availability. The waiting time for tractors played a decisive role as to when the cultivation cycle could begin. Many of the farmers we spoke to complained that they planted late because of problems with tractor availability, resulting in decreased yields. The use of oxen for ploughing was not adopted to a high degree, although it appeared the farmers who did use oxen for traction seemed to have a higher productivity than farmers hiring tractors for some reason.

One of the ways of getting around the difficulties of raising means for traction was the use of sharecropping. This was mainly adopted by farmers with low means.

Another major constraint, as perceived by most of the interviewed farmers was the lack of farming inputs. Chemical fertilizers, which everybody seemed to utilize to some extent according to the findings in the general questionnaire, was a main priority for most of the farmers. In order to raise capital for these inputs, the majority of the farmers had some alternative source of income, such as selling grass mats and weeding for other farmers in the village. Although most of the farmers applied fertilizer to their fields, the quantities were seldom sufficient compared to recommended values for the area by the extension officer. From our nutrient calculations it also appeared that the applied amounts of N, P and K were to low, compared to what the maize production theoretically extracted from the soil, resulting in a depletion of nutrients in the long run. The soil test confirmed that there was a general lack of N and P, but did not show a significant difference between the various plots. Interestingly we discovered that farmers who use manure have a higher productivity, but it was hard to define the exact causal relation for this. The soil tests did not show consistent differences in nutrient composition between fields where manure was applied and fields where it wasn’t. In general the way that the soil condition affects and is affected by the farming strategies for was hard to estimate.

The soil erosion in the area did seem to be a problem in some areas in Zombodze, but our measurements failed to give quantifiable results due to methodological difficulties. However we observed marked signs of erosion in the soils of zone 5.

The distribution of knowledge seemed to be a problem to some extent, as we found a clear correlation between the education of farmers and their productivity. However again the causal relationships were hard to establish. The recommendations put forward by the extension officer were not followed by most of the farmers in the area, and it was clear that the contact between the farmers and the extension service in the area was poor.

From our findings we conclude that the above mentioned factors represent major constraints to the productivity and soil conditions in the area. However increasing the access to inputs does not necessarily result in improved livelihoods for the people of Zombodze, as other factors (access to markets and competition from S.A) affect the possibilities for farmers to make a profit from farming

Acknowledgements

We would like to thank the following people for valuable help in relation to the different phases in the making of this project.
From Denmark: Our supervisors Andreas De Neergaard and Quentin Gausset for great help before, during and after the field trip. Also a great thanks to Torben Birch Thomsen for inspiration, support and help during the field trip.
From Swaziland, South Africa and Botswana: Absalomb Manyatsi, Trevor Hill for help and supervision during the field trip.
From Zombodze: Our interpreters MT and Jabulani Shongwe for invaluable help in the field, our host families for their generosity and kindness in hosting us. The people of Zombodze for being so open and helpful and helping us in the conduction of the inquiries.
Our African counterparts Sazi, Nhlanla, Ester and Jemma for a unforgettable experience and help in the collection of data and making of the project.

Litterature

Benton Jones, J. (2001): *Laboratory guide for conducting soil test and plant analysis,* CRC press Boca Raton, USA. pp. 71-85.

Brady, N.C, Weil, R.R. (1999): *The nature and properties of soils.* Twelfth edition. Prentice-Hall. Upper Saddle River, New Jersey, USA. pp 454-455.

Glendinnig, J, S. (1999): *Australian soil fertility manual,* CSIRO publishing Collingwood, Australia. pp. 6-29.

Henao, J & Baanante, C (1999): *Nutrient Depletion in the Agricultural Soils of Africa* [online]. IFPRI Publications, 2020 Vision. Available at htttp://www.ifpri.org/2020/briefs/number62.htm.

Manyatsi, Absalom M (2003): *Land use strategies in Swaziland and their Effects on Sustainable Use and Management of Agricultural Resources*. **In:**

Neff, J.C., et al (2002): *The origin, composition and rates of organic nitrogen deposition: a missing piece of the nitrogen cycle?* [Online], Kluwer academic publisher. (Printed version published in 2002). Downloaded 25/03/04. Accessible on the internet: www.geode.colorado.edu/~jneff/publications/neffbiogeochemestry 2002.pdf

Paliwal, R. L., *et al* (no year): *Tropical maize improvement and production.* FAO, plant production and protection series no.28 p.p. 247

Smalling, E.M.A., *et al.* 2002: *Decision Making on Integrated Nutrient Management through the Eyes of the Scientist, the Land-user and the Policy Maker.* CAB international. Integrated Plant Nutrient Management in Sub-Saharan Africa.

Appendix A

Interview guide for the farmers

GENERAL INFORMATION:

Household nr___ Household name_____ Date_____

Location (GPS)_____

Interview conducted by_____ Interpreter_____

Name of respondant_____

Position in household_____

Land tenure

Amount

Security (time)

Manure/fertilizer

Type

Amount

Management strategy

Traction

Equipment

Ownership

Management strategies

Life stock

Management strategies

Production

Subsistence/ commercial farming

Limitations/improvements

Labour

Presence of labour (from household and from out side) during different stages of cultivation

Irrigation

Strategy

Extension service

Appendix B

name	producti	fertilizer	grain N	grain P	grain K	all N	all P	all K
Ndlanga	0,6	0	-15	-3,6	-9	-24	-5,4	-19,8
S. Ndlovu	1,46	460	-7,59	34,61	7,01	-29,49	30,23	-19,27
T. Ngozo	1	370	-1,74	28,89	8,26	-16,74	25,89	-9,74
TN´s neighb	0,8	370	3,26	30,09	11,26	-8,74	27,69	-3,14
Lushaba	1,75	375	-20,18	24,86	-2,68	-46,43	19,60	-34,18
A. Dludlu	0,98	350	-2,5	27,12	7,3	-17,2	24,18	-10,34
Shabangu	0,76	0	-19	-4,56	-11,4	-30,4	-6,84	-25,08
	t/Ha	kg/Ha	kg/Ha	kg/Ha	kg/Ha	kg/Ha	kg/Ha	kg/Ha

Appendix C

ID	Date of collection	Household	Location	Zone	Ph	K gr /kg (soil)	P Kg(P) /kg (soil)	EC (dS/m)	Nitrogen (%)	Organic carbon (%)	R
A	19/01/04	16	Field with small crops	1	7,5	8	3,26e-5	0,3	0,251	2,937	1
B	20/01/04	Simelane	Bottom	5	6,9	7	3,26e-5	0,4	0,226	2,554	1
C	20/01/04	Simelane	Upper section bottom field	5	6,5	9	3,26e-5	0,4	0,145	2,102	1
D	19/01/04	16	Field fert/manure	1	6,0	7	3,26e-5	0,5	0,156	2,281	1
E	20/01/04	Simelane	Bottom	5	5,7	9	3,26e-5	1,3	0,037	0,603	1
F	19/01/04	3	Field 1	5	6,6	6	8,15e-5	3.4	0,371	3,935	1
G	20/01/04	Simelane	Uncultivated	5	5,5	8	3,26e-5	0.3	0,124	1,827	1
H	20/01/04	3	Far from kraal	5	5,4	9	3,26e-5	0,5	0,089	1,46	1
I	19/01/04	Ndlovu	Field 1	5	4,8	7,5	3,26e-5	2,2	0,135	1,852	1
J	19/01/04	4	Cultivated field	1	5,0	7	3,26e-5	0,9	0,080	1,21	1
K	19/01/04	1	Cultivated field	4	5,2	2,5	3,26e-5	1,0	0,088	1,176	1

L	19/01/04	Ndlovu	Field next to kraal	5	6,3	4,5	8,15e-5	3,1	0,121	1,74	1
M	19/01/04	4	Cultivated field	1	5,4	7	3,26e-5	2,7	0,12	1,516	1
N	19/01/04	Ndlovu	Field1	5	5,1	4,5	3,26e-5	1,5	0,346	4,281	1
O	19/01/04	9		9	5,8	4,5	3,26e-5	5,9	0,027	0,505	1
P	20/01/04	Methembu	Field	8	4,9	2,5	3,26e-5	1,5	0,062	0,993	1
Q	20/01/04	Methembu	Field	8	5,9	7	3,26e-5	5,8	0,129	1,671	1
R	20/01/04	Shabangu	field	8	6,0	2,5	1,63e-5	0,2	0,047	0,762	1
S	20/01/04	Shabangu	Near kraal	8	6,3	4,5	3,26e-5	1,7	0,083	1,02	1
T	20/01/04	Dlamini	Field 1	9	5,7	2,5	1,63e-5	0,2	0,100	1,364	1
U	20/01/04	Dlamini	Field 3	9	5,3	3,5	3,26e-5	0,3	0,070	1,033	1
V	20/01/04	Dlamini	Field 2	9	6,0	2,5	3,26e-5	0,2	0,041	0,625	1

DIARY OF FREDDY FEBRES (ZOMBODZE, SWAZILAND - 2004)

DATE 16/01/04

We arrive to zombodze late in the afternoon, and then a guide follow us went with a guide to the respective households where we would reside for ten days.

When we arrived to the household, the members of the family came to us and, gave us a welcome.

We went to the community hall where, the whole student group Africans and Danish would meet to do mutual activities, like to eat, to have meetings, etc. The whole group meted there to eat dinner and also because, the people of Zombodze want to give us a welcome.

DAY 1 DATE 17/01/04

After the breakfast, we meet up (the soil group) to make a strategy about the day in the field. In our group were 8 participants, due to this number of people we decide to split up in two groups of 4 people, in order to cover the most of the village in the less time possible.

We (Jemma, Ditte, Sazi, Freddy) and our interpreter that day (Jabulani) where visiting farmers in zone 1. The households visited were randomly selected a crossed the main road.

The collecting of data through questionnaires took us the whole day. we came back to the community hall and meet with the rest of our group. We converse and count the number of fulfilled questionnaires.

At the end of the day, a common meeting between professors and students was realised, to evaluate the day's work. Then dinner and come back to the households and sleep.

DAY 2 DATE 18/01/04

We split up in groups with Jemma, Sazi, Ditte, Noel, myself and Jabulani as interpreter. We went to zone 1, and more questionnaires were conducted during the most of the day. Then when we comeback to the community hall, we meet us with the rest of our group to select households to conduct interviews and take soil samples.

DAY 3 DATE 19/01/04

We all the soil group, decided to go to zone 5 and conduct interviews. In order to conduct as much interviews as possible we split in two groups. The interviews were conducted and soil samples were collect.

Sazi, Nhklanka, and myself after the realization of the interviews in zone 5 and, after previous agreement with the rest of our group, we interviewed the extension worker. When the interview with the extension officer finished, put the soil collected to dry.

DAY 4 DATE 20/01/04

Martin and me with Andreas and M.T. decided to conduct interviews, collect soil samples and dig gutters in zone 5. I start to analyze the soil samples.

DAY 5 DATE 21/01/04

Ditte and me conducted interviews, and collect soil samples between zone 8 and 9. Appointments with those farmers that were interviewed were made for the realization of the second PRA session.

DAY 6 DATE 22/01/04

It was raining too much, and we just did the digging of gutters and conduct more soil analysis.

DAY 7 DATE 23/01/04

It was our day off. We went to South Africa, and had a great time in “the safari boat and later on pushing cars”.

DAY 8 DATE 24/01/04

Jemma and me when to collect the soils collected in the gutters. Later on, measurement of water infiltration rate were conducted I different zones (5, 8) by Jemma, me, Noel, Andreas.

DAY 9 DATE 25/01/04

I conducted more soil analyzes, and late on together with Ditte, Trevor, Sazi we went to the gullies.

DAY 10 DATE 26/01/04

The whole group were preparing the presentation of our field work to the whole community.

DAY 11 DATE 27/01/04

Departure to Manzini. Back in the hotel in Manzini group work were realized.

DAY 11 DATE 28/01/04

Group work at the university in Manzini, and I finished with the soil analysis.

DAY 12 DATE 29/01/04

Presentation of our field work in the university in Manzini.

Diary of Martin Pihl Jensen

Tues. 13/1: Introduction to the project at UNISWA by the staff, and meeting the Southern African groupmembers. General introductions of ourselves and discussion the overall aims and methodologies.

Wed. 14/1: Group work at UNISWA on methodological considerations on data collection in Zombodze. Work on common questionnaire.

Thur. 15/1: Group work mostly on questionnaire, and introduction to do's and don'ts in the field.

Fri. 16/1: Departure for Zombodze and welcome ceremony by the village.

Sat. 17/1: Implementation of the general questionnaire with half the soil group in Zone 5.

Sun. 18/1: Idem.

Mon. 19/1: Morning: selection and interview in zone 5 to households chosen from preliminary data from the questionnaire, also present Torben and Cathy.
Afternoon: interview in Zone 1 with poor woman practicing sharecropping.

Tues. 20/1: Morning: Interviews in zone 5 with Freddy and Andreas and digging on gutters in fields of mr. Simelane.
Afternoon: Interviews in zone 8: Interview in zone 5 with prosperous farmer practicing irrigation + digging in gutters in his field.

Wed. 21/1: Morning: preparation for PRA session 1, w. Ester, Nhlanla, Cathy and Torben helped.
Afternoon: PRA session 1, evaluation w. Torben and Cathy.

Thur. 22/1: Morning: Preparation for PRA session 2
Afternoon: PRA session 2, evaluation w. Andreas and Torben.

Fri. 23/1: Off.

Sat. 24/1: Morning:Data analysis and interview with Mr.Lushaba at community hall.
Afternoon: Interviews in zone 1and 8 w. Ditte and Jabulani.

Sun25/1: Morning: interview w. mr Khumeme in zone 8
Data analysis and interviews with interpreters.

Mon 26/1: Morning: preparation for presentation for villagers and data analysis.
Afternoon: data analysis.

Tues27/1: Dep. for Manzini

Afternoon: Groupwork in Manzini.

Wed 28/1: Group work at UNISWA and preparation for the final presentation

Thur. 29/1:idem

Fri.30/1 : Presentation of project at UNISWA and course evaluation.

Diary for field trip in Manzini and Zombodze, Ditte Gundermann

Tues 13/1	introduction to the the area at UNISWA.
Wed. 14/1	group work at UNISWA, preparing for field trip. Work on general questionnaire.
Thurs 15/1	group work and information on to do´s and don´ts.
Fri 16/1	departure for Zombodze and welcome zeremony and party in Zombodze.
Sat 17/1	Conducting general questionnaire in homesteads in zone 1:
Sun. 18/1	idem
Mon. 19/1	Morning: group meeting and planning the activities of the day. Interviewing farmers, taking soil samples and making area meassurements in zone 5. (Sphiwe Ndlovu) Afternoon: interviewing farmers in zone 1 (Thoko Ngozo).
Tues. 20/1	Stratification of farmers for interviews and analysing SPSS data.
Wed. 21/1	Morning and afternoon: Interviewing farmers, taking soil samples and making area meassurements in zone 9 (Flora Dlamini, Zake Shabangu) and making appointments for thursday s PRA session. Digging in gutters in zone 8/9.
Thurs 22/1	Morning: Interviews with farmers in zone 1. Afternoon: evaluation of PRA session and group meeting.
Fri. 23/1	Day off
Sat. 24/1	Morning: interviewing farmers in zone 10 and 1 (Mr Lushaba, wife of Aaron Dludlu). Making arrangements for moving (our hut was falling apart). Afternoon: interviewing farmers in zone 1. Watching the football game.
Sun. 25/1	Morning: going to church. Interviewing our interpreters. Afternoon: going to the gulleys in zone 5.
Mon. 26/1	Morning: Tooth pain. Afternoon: presentation for villagers.
Tues. 27/1	Morning: Departure for Manzini. Afternoon: group work at the hotel.
Wed 28/1	Preparing for presentation.
Thurs 29/1	idem
Fri 30/1	Presentation and evaluation.