Learning, Practices and Sustainability on Community Gardens in The Gambia

An analysis of the Knowledge Generation Process, Circumstances, Social Capital and Sustainable Land and Water Management Practices

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Abstract

In the face of climate change and creating resilient local food systems, it is important for community gardens to have sustainable land and water management practices. The main research question ‘What are the possibilities and constraints for sustainable land and water management in terms of learning and practices on community gardens in The Gambia’ has been assessed by conducting interviews with 61 people working on the gardens, with some agricultural extension workers and by doing field observations on three different community gardens in The Gambia. The practices being done are related to the learning process of the women in these gardens, the circumstances and social capital. To make these gardens more sustainable, the local context and the ability of the women working in these gardens to be able to continue and to sustain their livelihoods should also be taken into account.

To create more sustainable land and water management practices in the gardens, improvement can be made on different levels; on the learning process, less use of external inputs, improved sustainable land and water management practices and efficiency. Farmer-to-farmer learning in the gardens can be enhanced by extension workers facilitating meetings among the women. Since water availability is a main concern, sustainable practices should focus on increasing the water holding capacity of the soil and limiting (evapo)transpiration and making efficient use of the available water. The teacher-student learning from extension workers can be improved by including sustainable traditional practices, such as the use of groundnut shells as mulch, the use of ashes and of bio-chemicals in their knowledge transfer and providing the women in the gardens with more knowledge on sustainable water management; how much water certain crops need at what stage of growth and how to make more efficient use of the available water. Experimenting with different practices can be done as well in the gardens with help from extension workers and/or the research centre NARI.

Bonding, bridging and linking social capital is important in the gardens for the knowledge generation process, collective action and access to resources. Bridging social capital can be improved by creating better connections between women in the gardens, this can be done by extension workers facilitating meetings among the women. Linking social capital can be enhanced by creating more links with other organisations such as the NARI, the agricultural department and local and/or export markets.
1. Introduction
When going around in The Gambia in the dry season, you will notice that there is very little area being used for agriculture. Sometimes you will come across a community garden where women are watering, weeding, chatting or having lunch together. Some of these gardens have wells which are dug out by the women, these are called ‘local gardens’. If there is a fence, it is made from wooden sticks which are put into the ground. Sometimes you will come across a community garden which has a good fence and a water supply from a water tank which pumps up groundwater with electricity which is sometimes provided by solar panels. These are the more ‘upgraded’ community gardens. The people working in the community gardens are almost always women, sometimes helped by their children. It seems like a nice hobby for them since they cultivate crops on very small plots, but while talking to the women you will find out that it is an important source of food and income for them and their families. A lot of them will say that their children have a future because of their work in these gardens. This research has been conducted on three community gardens in The Gambia to find out what the land and water management practices are, how learning about these practices take place and what the possibilities and constraints are for achieving sustainable community gardens.

1.1 The Gambia
The Gambia is a small country within Senegal. The primary export products of The Gambia are groundnut, millet and rice (FAO STAT, 2015) The Gambia is among the poorest countries in the world. Poverty is mostly present in the rural areas and women are more vulnerable to income poverty than men. Around 80% of the economically active population works in the agricultural sector. There are different factors that cause the widespread poverty, among which a low and decreasing soil fertility, low agricultural and labour productivity (Rural Poverty Portal, 2015). Farming is mostly subsistence rain fed farming. Even though a large part of the population in The Gambia is a subsistence farmer, a lot of rice is being imported, which creates a dependence on the global market and it can create problems in terms of food security when the food prices rise (Moseley et al., 2010).

The farmland can be classified into upland, where the soils are mostly cultivated by men and the main crops being produced are groundnut, early millet, maize and sorghum; and the lowland where it is mostly the women cultivating the soils and the main crop in the lowland is rice in the wet season and vegetables in the dry season (FAO AquaSTAT, 2014). There are two main seasons, a wet and a dry season, the wet season lasting from June until October.

1.2 Sustainable land and water management
Soil fertility depletion is an important constraint to food security. As a large part of the population is involved in subsistence farming, sustainable agriculture is important in The Gambia (Bationo et al., 2007). Degradation of the cropland is also taking place due to the increasing population pressure, which requires a more intensive use of the cropland.

Climate change can cause more frequent drought events and because the farmers in The Gambia are so much dependent on the rain for growing their crops, climate change can have severe effects on the food security and the livelihoods of the people (Jaiteh, 2011). It is very important to maintain food production for a fast growing population. Effective recycling of organic material such as crop residues and using manure are essential to maintain soil fertility for the croplands in The Gambia (Bationo et al., 2007).
1.3 Community gardens
Community gardens are a way of promoting household food security or to provide an (extra) income for the ones working there. It differs how the community gardens are organised, but usually the community garden is divided into different plots and families can grow food there. It enhances the local food production, and especially in the dry season it is an important source of food and income from agriculture in The Gambia. Water is scarce, and it is on the community garden where they can grow some crops because there is a water tank and it is fenced from animals. Local food production together with a nutrition education programme is a good way to combat micronutrient deficiencies in rural areas (Faber et al., 1999). Broadly speaking, there are two different types of community gardens in The Gambia; the ‘local gardens’ (as the people there call them) which do not have a water pump or water tanks, but hand-dug well where they get the water from, and community gardens with a water pumping system and water tanks.

In community gardens, social capital is important (Grootaert and Bastelaer, 2001). Social capital is defined as one of the five key assets (the human, social, physical, financial and natural) for sustainable livelihoods. Social capital is defined as ‘the institutions, relationships, attitudes and values that govern interactions between people and contribute to economic and social development’. It can be divided into three different domains; bonding social capital, bridging social capital and linking social capital which are all important for community gardens to have a safety net, have access to opportunities and information and resources (Firth et al., 2011). Social capital in community gardens can contribute to collaboration, learning and collective action (Krasny and Tidball, 2009).

There are some developments taking place that affect the agriculture and community gardens in The Gambia. One of them is climate change, which will probably lead to a different rainfall pattern with an increase of the amount of dry days and higher intensity rainfall (Sillah, 2014). Another recent development is the increasing access to Internet and electricity (The World Bank, World Development Indicators, 2014). Although with 31% of the population connected to the power grid (The World Bank, Access to electricity, 2014) there are still many people not connected.

1.4 Sustainable food systems
As the current food system is going towards globalisation, economic consolidation and environmental degradation, there is another movement which tries to make food systems more local and more sustainable (La Trobe and Acott, 2000). That movement consists of people who attempt to integrate the environmental, economic and social aspects of their food system. Important aspects of creating a more local and sustainable food system are public participation, new partnerships and giving importance to the social, economic and environmental aspects (Feenstra, 2002). An important aspect of the vitality and the sustainability of a community is the long-term health of its food system (Feenstra, 1997). It is important to create links between people and between the environment, food and people and community gardens can be a tool for that.

Community gardens often have strong links with the community through the people working in these gardens and the local markets where the products are being sold. It can be a source of traditional knowledge on agriculture, since knowledge is often transferred from generation to generation (Thrupp L., 1989). Resilience is an important aspect in these gardens. Resilience is the system’s ability to maintain normal functions in the face of unexpected conditions (Borron, 2006). In community gardens, these shocks can come as long periods of drought or shocks in the market prices. It is related to the dependence on their own resources instead of external inputs and their ability to experiment with different practices to see what works best (Borron, 2006).
2. Research background
The community gardens in The Gambia where the research has been conducted are a community garden in Banjulinding, a community garden in Yundum and a community garden in Marakissa. They are all located near the West-Coast of The Gambia (Fig. 1). These cases have been selected because they are active community gardens, where more than 120 people are working. All of them have had or still have some kind of agricultural training program for the ones working there. They all have water available and the area is fenced so that animals cannot get in and eat the crops, which are both necessary to be able to grow crops in the dry season.

Figure 1: Location of the places of research

2.1 Banjulinding
The community garden in Banjulinding is 23 ha in size. It was sponsored by the Taiwanese government under the Taiwanese Technical Mission (TTM) supporting development in The Gambia (Baker, 2003). There are 121 people who work in the garden, almost all of them are women. They mostly work on a piece of land in groups of five and they got training on agricultural practices by the Taiwanese. The TTM retreated from the community garden after some problems between the government of The Gambia and the Taiwanese government. There is an agricultural extension worker from the agricultural department who work in the garden to advise them about agricultural practices (Interview president Banjulinding garden, 02-03-2015).

2.1.1 Background
The Banjulinding community garden started about 25 years ago with some women farming on the land. The group grew as more women joined the farming. At that time, the land was only being used for crop production in the rainy season. One day the president of The Gambia stopped by and asked the women what they were doing. He asked if they wanted a real garden. They said they did, so he invited the Taiwanese to the garden and they started working together with the TTM. They provided the garden with a fence, boreholes, water tanks and taps. They provided them with fertilizers, agrochemicals, black plastic to cover the soil and seeds and they made a cropping plan for the whole garden. The crops were mainly being grown for export. Because of the more favourable conditions for growing crops in this garden compared to other gardens, more people came to farm here. Twenty years ago there was some sort of problem between the government of The Gambia and the Taiwanese government, so they stopped their collaboration. The president of The Gambia also linked them to the agricultural department. It is the oldest garden of The Gambia.
2.1.2 Organisation

There are two boreholes that work on electricity which both provide water for an area of 8 ha and one that works on solar power which provides water for 15 ha. There is a watchman present during the night for security reasons. In the garden they mainly work in groups of five women and each group has three different pieces of land in different parts of the garden. At the time of visit (February 2015), only 2 plots are in use because of a lack of water. The group plots are 14 by 13 meter. If someone wants to join a women’s group, she has to pay 2000 Dalasi (45 Euros). The men can only have individual plots. At this moment, there are ten men working in the garden. An individual plot costs 500 Dalasi (11 Euros) and they are 7 by 7 meter.

Each group has a leader and someone who is responsible for selling the crops. The leader checks the money and goes to the credit place. Of the total profit, 25% goes to the common account of the garden which is being used for if things break down to fix them etc. and the remaining 75% is for the women.

The garden has one president and the current president has been in this position since 1996, when the TTM left. The president, the vice-president and the secretary were chosen by the people of the community because the TTM wanted the women to control the garden when they left. Currently they have no sponsors to support the garden. From Monday to Thursday an extension worker is present in the garden, she walks around and gives advice and she is paid by the government.

The produce is not directly being sold on the market by the women themselves, but the crops are stored in a storing house on the garden and people come to the garden to buy the produce and sell it at local markets.

2.1.3 Agricultural trainings

From Monday to Thursday an extension worker is present in the garden. The extension worker has different tasks in the garden; she weighs the crops after harvest and she sends some people to the market to look at the prices for the crops before they decide on what the price will be. They sell it with the same price as the crops being sold on the market. If there are for instance a lot of tomatoes on the market, they reduce the price of their tomatoes.

Another task of the extension worker is to walk around and see if there are any problems related to diseases and pests. If she sees that there is a problem on some beds, she first tells them to spray agro-chemicals. If that does not work she tells them to uproot it so that the disease does not spread. She doesn’t know what chemical is best to use, but there are some guys on the garden responsible for spraying agro-chemicals and they know what chemical to use. The women also sometimes use leaves of the neem tree or laundry soap or garlic (pound it and mix it with water). But mostly they use agro-chemicals (Interview Agricultural Extension Worker, Banjulinding Community Garden, 30-03-2015).

The black plastic is used to keep the water and to prevent weeds from growing. This is only possible with some crops like tomato and cucumber, because with, for instance, groundnut the plastic will be destroyed during uprooting, because of its’ extended root system. According to the extension worker it is not possible to cover the soil with something else.

2.2 Yundum

A bit further South, in the next village of Yundum, there is another community garden where 123 people work (mostly women). They have both individual plots as well as plots which they share with more people. The people working there have no garden or farm at home, so this community garden is the only place where they can grow some crops. About once a month, agricultural extension
workers from the agricultural department come there to give training on agriculture (Interview president Yundum garden, 03-03-2015).

2.2.1 Background
The garden started with a group of women who were working on farms through hired labour. Ten years ago they used the money they earned to buy a piece of land and to start this garden. At that time they only grew crops in the rainy season, mainly rice, cassava, groundnut and maize. Five years ago the GALDEP project came here and they sponsored the water tank, the borehole and solar panels which made it possible for them to also grow crops during the dry season. This was a project funded by the government to support community gardens and the solar panels they still have to pay back. There is a watchman for security reasons, because a couple of years ago the solar panels got stolen. The same women who started the garden are still here now, but the group expanded when friends and family members started to join. The women all live in Lamin.

Another company came to the garden to grow hot pepper for export. A piece of land is currently being used to grow hot pepper and the women work the land together.

2.2.2 Organisation
The whole garden is divided into beds of around 1 meter in width. The length depends, in the front part of the garden the beds are around ten meters long, in the back of the garden they are 5 meters long. Every woman working in the garden has either five of the shorter beds of five meters or two beds of ten meters long. One-third of the garden is owned by the association and is currently being used to grow hot pepper in collaboration with an export company. Another part of the garden has mango trees growing between the crops. They have been planted with the GALDEP project and the mangos are being collected and processed as jams and the jam pots are being sold to hotels and supermarkets in the region.

There is a president in the garden who was part of the group of women who started the garden. The women decide themselves who becomes part of the garden. It also happens quite often that a daughter takes over the plots of her mother. They have a common bank account to pay for maintenance and to pay the watchman and they buy groundnut shells in large quantities together. They also try to do this with spraying agro-chemicals that everyone gives some money for agro-chemicals but this doesn’t work since not everyone is paying.

They put their produce together and one of them goes to local markets to sell the crops. The money is then divided among the women.

2.2.3 Agricultural trainings
Every year, two women get chosen to go to a workshop on agriculture from the agricultural department in Latrikunda. There they learn how to plan a garden, how to plant, how to prepare the beds and how to apply fertilizer. These women are then responsible for sharing that knowledge among the others. Sometimes an agricultural extension worker comes to see the work they are doing and to give advice.
2.3 Marakissa
The third community garden which is of interest for this research is the community garden in Marakissa. There it is also the women of surrounding communities having a small plot and in total 450 women are working there. The water supply comes from a water tank and the area is fenced so that animals cannot come in to eat the crops. Sometimes the women get some training on things like how to use an irrigation system (Interviews with people working in the Marakissa garden, 23-02-2015).

2.3.1 Background
This community garden was a local garden before with dug out wells. It was mainly being used by women from the village Marakissa during the rainy season for rice production. In 2011 the GALDEP project started in the garden who sponsored the fence and the water tank. More people from different surrounding villages came to this community garden after this development.

2.3.2 Organisation
Women can join the garden if they pay the fees, which are 25 Dalasi (0.57 Euros) per person per month to pay the watchman. The garden has a president and three women have been appointed to be responsible for selling the crops in local markets. There is no place to store crops in the garden. These women collect the crops from the women and go to local markets and the money is then shared among the women according to their own produce.

A part of the garden is being used for a hot pepper project done by an export company. On this part, the women work together, on the other parts the women have their own plots. The project GGCP (Gambian Growth and Competitive Project) is focussed on growing hot pepper for export. The aim is to teach the women how to grow hot pepper so that the export company can work together with them and export their crops. They provide the input; seeds, agro-chemicals, irrigation system and fertilizers and the project will last for one year. The money then goes to a bank, they get an equal share. The project is also implementing drip irrigation on the area where hot pepper is being grown. The project gives workshops. They take the president, vice-president and some others in the garden and take them to the office and the idea is that they pass on the information to the other women (Interview Project Guy, Marakissa Community Garden, 10-04-2015).

2.3.3 Agricultural trainings
There are different types of knowledge generation processes present in the Marakissa community garden. The project promoting the cultivation of hot pepper is giving trainings outside of the garden to a select group of women. There is also a woman who is in training to become an agricultural extension worker who organises weekly meetings with all the women of the garden who want to join so they can exchange ideas and difficulties they face. She does not give direct advice, but she facilitates the meetings. Sometimes she goes around in the garden and advises people on for instance the amount of fertilizer they should apply.
3. Problem statement

Food insecurity is an issue in The Gambia. Most of the population lives from subsistence farming and thus sustainable agriculture with good land management practices is important. During the dry season in The Gambia, almost nothing can be grown without water and without fencing off the land from animals. In community gardens where there is a supply of water and a fence around the area, the people have an opportunity to have an (extra) source of food and income. Sustainable use of these gardens is important, because they are used intensively with a high labour input and little resources. The community garden is a place where people and knowledge come together and this can be used to bring in new knowledge and ideas on sustainable land and water management practices. There is collaboration with agricultural extension workers in the gardens, but it is unclear what is being taught, what the people working in the community gardens know about sustainable land and water management, where they got their knowledge and how the current learning process is happening.

Since community gardens play an important role in the food security of families, the economic, social and physical sustainability are important. These factors all come together in the actual land and water management practices in community gardens. In order to improve the sustainable land and water management practices, it is important to know what the knowledge is on land and water management of the people working there, what their practices are, what the circumstances are and how they learn(ed) about land and water management. With that information, an assessment can be made on what the possibilities and constraints are for the knowledge generation process and sustainable land and water management practices on community gardens in The Gambia.
4. Research questions and methods

4.1 Research questions

The main research question is: ‘What are the possibilities and constraints for sustainable land and water management in terms of learning and practices on community gardens in The Gambia?’ This research question will be answered by doing research on three different community gardens; the Banjulinding community garden, the Yundum community garden and the Marakissa community garden.

To be able to answer the main research question, the following sub-questions have to be answered.

1. What are the land and water management practices of people working in the community gardens?

This question has been assessed by doing interviews with the ones working on the community gardens and field observations of their plots and of the community garden as a whole. The following things have been assessed:

- Crops
  - Which crops are being grown?
  - Why these crops?
  - What is the use of the crops?
- Land management
  - Mulching, ridges, planted in rows etc., fertilizers, pesticides
- Water management
  - How often do they water?
  - How much water do they use?
  - What is the source of the water?

2. Where and how did they learn about these practices?

This question has been assessed by doing interviews with the ones working on the community garden and interviews with agricultural extension workers and people giving trainings on community gardens. The following topics were included:

- Where did/do they learn (in school, farm of parents, on the community garden etc.)?
- What did/do they learn (relate it to their practices, why do they do what they do)?
- How did/do they learn (type of learning; farmer-to-farmer, teacher-student, transgenerational, experience/ experimenting)?
- How often do they go to a training?
- How practical were these trainings?

3. How sustainable are these practices?

The perception of sustainability of the ones working in community gardens has been assessed through interviews questions on why they do certain things, what their drivers are to do certain practices. This has been combined with observations of the plots of the interviewee. By doing that, the meaning of sustainability for themselves has been assessed and the local context of sustainability can be taken into account. According to answers of the
interviewees and observations, the meaning of sustainability in that context, the 'local' sustainability has been assessed and which aspects and circumstances play a role in the use of certain practices.

The sustainability of their practices has been assessed according to these three pillars of sustainability:

- less use of external off-farm inputs;
- improved management techniques and practices;
- use locally available natural resources and purchased inputs more efficiently.

These aspects, together with the local perception and local context have been used to get to an answer to this question.

4. What is the relation between the type of learning, circumstances, social capital and land and water management practices on the community gardens?

This question has been assessed by combining the findings of the interviews and field observations together and putting it in a broader perspective. The links between the different types of learning, different types of knowledge, land and water management practices, circumstances and social capital that influence the land and water management practices of the ones working in the gardens have been analysed.

4.2 Methods

As already indicated in the sub-questions above, a mix of methods was used. Both interviews and field observations have been done. The interviews were semi-structured, with some prepared questions but leaving enough space for people to talk about what they think is important. The interviewees have been selected by going to the community garden during watering time (which is different per community garden according to when there is water available) and by going to different water collecting points on the community garden to meet people who are working there to interview them. A translator with good knowledge of the English language and of the local languages was helping with translating the questions and answers.

In total 61 people working on the gardens have been interviewed. Twenty interviews have been done in the Yundum and Marakissa community gardens and twelve interviews in the Banjulinding community garden (see Annex A for interview questions), of which nine group interviews (which were counted as two interviews compared to the other gardens). On the Banjulinding and Marakissa community garden extension workers and someone who was working with a project on the garden have been interviewed. Another two interviews have been conducted with the NARI (National Agricultural Research Center) of which one with someone working on an experimental field and the head of the NARI. Field observations of the community garden as a whole and of the plots of interviewees have also been done.

The analysis has been done both in a qualitative and quantitative way. The qualitative data collected through interviews have been used for understanding the links between learning, practices, circumstances and sustainability and the important factors contributing to that. Quantitative data about how many people say a certain thing for example have been used to find out how important these links are and how they differ per garden.
5. Key concepts and theories

5.1 Community gardens
Community gardens are heterogeneous environments that integrate environmental restoration, community activism, social interactions, cultural expression, and food security. In these type of gardens, collaborative learning occurs (Krasny and Tidball, 2009). They can address many of the elements that sustainable development hopes to engage in; environmental protection combined with social inclusion, educational programs that look at new forms of growing crops, and the participation in food provision. These aspects are important when looking at the sustainable development of a community (Holland, 2004).

5.2 Learning, knowledge and practices

![Diagram of learning types]

In the figure above (Fig. 2) a schematic overview can be seen of the relation between learning, knowledge and land and water management practices on community gardens. There are different types of learning, which influence the knowledge that people have on land and water management and that in turn influences and determines their agricultural practices. The different types of learning that will be studied in this research are the trans-generational learning, farmer-to-farmer learning, teacher-student learning and learning through experience and experimenting.

Transgenerational learning means that knowledge is transferred from one generation to the next one, so people learn from their parents or from other elderly people.

Farmer-to-farmer learning means that knowledge is transferred from one farmer, or in this case someone who is working in the community garden, to another farmer. A study done by Kipkot et al. reported here has shown that farmer to farmer dissemination provides a potential alternative mechanism for the spread of agricultural technologies (Kiptot et al., 2006).

Teacher-student learning means that knowledge is transferred from an ‘expert’, for instance an agricultural extension worker or a scientist, to the ones who are actually working in the gardens.
Learning through experience means that knowledge is generated through experience over the years. Learning through experimenting happens when certain practices are done differently on purpose to see if they are more beneficial in one way or the other.

5.3 Social capital
Social capital is important in community gardens since it can strengthen links between people in community gardens and links with people outside of the gardens which can increase collective action, learning and access to resources. It can be divided into three different domains; bonding social capital, bridging social capital and linking social capital. Bonding social capital is having strong ties between individuals in similar sociodemographic situations, such as family members or friends. Bridging social capital refers to loose friendships or workmates. Linking social capital refers to the connectivity between people in dissimilar situations, for instance vertical links with people in power (Firth et al., 2011).

Bonding and bridging social capital is also related to farmer-to-farmer learning (Grootaert and Bastelaer, 2001). Bonding social capital is related to transgenerational learning since knowledge is transferred from one generation to another.

Linking social capital relates to teacher-student learning because teacher-student learning comes from ‘outside’, for instance extension workers, and to have that in a community garden the links with external agents are important. Linking social capital also relates to having access to funds/sponsors.

5.4 Sustainable land and water management
Community gardens are used intensively, thus it is key to use the available resources in a sustainable way. Sustainable land management can be defined as “a system of technologies and/or planning that aims to integrate ecological with socio-economic and political principles in the management of land for agricultural and other purposes to achieve intra- and intergenerational equity” (Hurni, 2000). This is a definition on sustainable land management, but sustainable use of water for agriculture is also included in this definition.

Knowledge and awareness of farmers on sustainability play a role in the land management measures they use. There are different practices that can be implemented to make agriculture more sustainable, such as using cover crops, mulching, using stone bunds or vegetation strips to keep the soil fertility and make sure that the erosion rate becomes as small as possible. Which practices are best to apply differs per location, because it is dependent on physical things such as climate, slope of the land and soil type. It is also dependent on social and economic factors, such as which practices are economically feasible, what crops people prefer to grow and what practices are better adopted. Physical and socio-economic realities both play a role in the farmers’ perception on sustainable land management and on the adoption of certain practices (Veih, 2000). The concept of sustainability has been defined above but the practical use of it is still a difficult issue. However, there seems to be a greater consensus on what sustainable agriculture is in practice;

- less use of external off-farm inputs such as purchased fertilizers, pesticides, mechanical inputs, etc.
- use of improved management techniques and practices
- use locally available natural resources and purchased inputs more efficiently (Lee, 2005).

In this study these have been used to assess the sustainable land and water management in practice. This has been done together with the viability of practices for the ones working in the gardens, because if certain practices are not viable in the local context there is little chance that they will be used.
Resilience, the system’s ability to maintain normal functions in the face of unexpected conditions (Borron S., 2006) is also an important aspect when looking at the ‘local’ sustainability.

A higher risk together with a high vulnerability to unexpected events can lead to a low resilience. Unexpected events that can have an effect in community gardens can for example be long periods of droughts, failing water systems or a decline in the market price of vegetables.
6. Results
In this chapter the results of the interviews and observations in the community gardens can be seen. It starts with an overview of the gardens; how they started, the main crops being grown, main practices etc.. Then the four sub-questions will be assessed; the land and water management practices, how and where they learn(ed) about these practices, the sustainability of these practices and the relation between the type of learning, circumstances, social capital and practices in the community gardens.

6.1 Overview
In the table below (Table 1), some key aspects can be seen per community garden which play a role in the land and water management practices in the gardens. These aspects have been chosen because they explain the (social) structure of the garden as it is nowadays; how the garden started, the social organisation, the main crops, the main practices which can be seen in the gardens, their main source of knowledge and what kind of learning is currently taking place. This information has been collected through interviews and observations. This is meant to give a general idea of the background of the different gardens and what is currently taking place.
Table 1: Some key aspects per community garden

<table>
<thead>
<tr>
<th></th>
<th>Start of the garden</th>
<th>Social structure</th>
<th>Main crops</th>
<th>Practices</th>
<th>Knowledge from</th>
<th>Current learning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Banjulinding</strong></td>
<td>The garden started 20 years ago with the TTM</td>
<td>Mainly work in groups of 5 women. Mostly from the Yola tribe but not all</td>
<td>Tomatoes, groundnut, eggplant, cabbage</td>
<td>Some crops they grow with a black plastic cover. Most of them use both local and chemical fertilizer and chemical pesticides</td>
<td>Mostly from the TTM 20 years ago, who used to work together with the garden and experience</td>
<td>Extension worker is present some days of the week</td>
</tr>
<tr>
<td><strong>Yundum</strong></td>
<td>20 years ago a group of women bought this piece of land for themselves. Three years ago the garden got as fence and a water system</td>
<td>Women from the same village and all from Yola tribe</td>
<td>Onions</td>
<td>Use of groundnut shells as mulch and use of ashes. Some use neem tree leaves as a 'local chemical'</td>
<td>Mostly through experience and family/ancestors</td>
<td>Extension worker comes once per month to give advice</td>
</tr>
<tr>
<td><strong>Marakissa</strong></td>
<td>Used to be a local garden, but four years ago the GALDEP project build a fence and a water system in the garden</td>
<td>Mix of women, from different villages and different backgrounds</td>
<td>Onions and other crops</td>
<td>Mostly use local fertilizers and little use of agro-chemicals</td>
<td>Mostly through experience and family/ancestors</td>
<td>The women in the garden meet every week</td>
</tr>
</tbody>
</table>
6.1.1 Banjulinding
The Banjulinding garden started 20 years ago with the TTM who provided trainings and materials for the women to work with. They mainly grow tomatoes, groundnut, eggplant and cabbage. The knowledge and the practices they learned from them are still very much in use nowadays. The use of black plastic cover for instance was introduced by them and is still being used, even though the TTM left twenty years ago. Compared to the other two gardens, the linking social capital was higher because they had more collaboration with other organisations and thus more connections.

Observations
There is a shaded greenhouse which is being used as a nursery. On most plots one of the following crops are being grown; groundnut, tomatoes, onions, some eggplant, some cabbage and some cucumber. Tomato plants are being grown with a black plastic covering the soil and with holes in it for tomato plants. This is also done for cucumber plants. When these plants grow bigger, they are being tied up to sticks which they put in the ground. Groundnut, onion and cabbage are being grown without black plastic to cover the soil. All the crops except groundnut are planted in rows. Some crops, like tomatoes and onions, are first grown on nursery beds, after which they are transplanted. On some plots they use plastic tubes with holes for watering. There is however not always enough pressure for the tubes to work, and if the electricity is off then there is no pressure at all.

On the individual plots there is more variety in the crops being grown. The group plots use their whole area for one crop, whereas on the individual plots different crops are being grown together such as onion, eggplant and sweet/ hot pepper. About one-quarter the land is currently not being used by the groups because of a lack of water. There are some people growing some things for themselves on a very small scale, but they are in a way squatting the land, as they are not officially working in the garden. Those people grow more cassava, onions and sweet pepper, sometimes intercropped. They do not use the plastic to cover of plastic tubes. A large area of that land is covered in grasses and is not being used.

6.1.2 Yundum
The garden in Yundum started by a group of women who were working on farms for money and they put the money together to buy the land where they created a community garden. This group of women expanded as other women joined, but it is still quite an uniform group. They are all from the Yola tribe and most of them live in the same area. This is reflected in the way they work in the community garden. The main crop being grown is onion (about 70% of the garden). Groundnut shells are bought collaboratively and they sell the produce together, because the produce per person is too small to go to the market with. The use of groundnut shells as mulch and the use of ashes and the leaves of neem trees as a natural protection is being done a lot more than in the Banjulinding garden. This could also be due to the size of the garden, with its’ 8 hectare it is considerably smaller than the Banjulinding community garden of 23 ha which could make the bonding and bridging social capital higher.

Observations
There is one borehole and water tank provided with electricity through solar panels. In the garden there are 24 water points. There is also a shaded greenhouse which is being used as a nursery.

The main crop being grown is onion, about 70% of the total area of the garden is being used to produce onions. Other crops being grown are tomato, bitter tomato, sweet pepper, okra, eggplant and cabbage. Usually, one crop is being grown per bed. Sometimes intercropping can be seen, mainly with onions and sorel (a local crop). On most of the beds, groundnut shells are being used as mulch and on some beds ashes can be seen on the soil and on the plants. Most of the crops are planted in
rows. On the part of the garden where hot pepper is being grown there is drip irrigation. The hot pepper plants are grown on ridges. Women work on that piece of land together.

6.1.3 Marakissa
The community garden in Marakissa used to be a local garden, with local (dug out) wells. Five years ago, due to a project funded by the government, they got a water system with a solar panel and water tanks. Because of this development, women from other villages came because the conditions in this garden were better than in their own local garden. This created a group of women from different villages and from different tribes, but most of them have a lot of experience in working in these kind of gardens and learned it from their ancestors. The main crop being grown is onion, but there is a larger variety of crops compared to the Banjulinding and Yundum community gardens.

Observations
The garden is a mix women from different villages and different backgrounds, different crops and different sizes of beds. Every women who is in the garden gets a certain piece of land, but some women work together to create a bigger area to grow crops on together and other women grow crops on pieces of land that have been abandoned by others.

The main crops being grown are onions and hot pepper (including the hot pepper project). Women also started to grow their own hot pepper plants because they got some free seeds from the project for themselves. Other crops that can be seen are tomato, okra, sorel, eggplant, cabbage and garlic. The hot pepper that is being grown by the project is being irrigated with drip irrigation. The plan is to expand this drip irrigation to the rest of the garden. On some beds, women use groundnut shells as mulch and on some beds ashes are being used. On a few beds dried mango leaves were being used as mulching material. On those beds termites were clearly present.

About a quarter of the garden is currently not being used because of a lack of water. On a couple of days of doing interviews, no water was being pumped and the water tanks were empty. According to the women, this happens occasionally and it makes it more difficult for them to grow their crops.

6.2 Practices
Here the first sub-question; ‘What are the land and water management practices of people working in the community gardens?’ will be assessed according to the findings from interviews and observations. The land management practices and reasons for doing these practices will be assessed, then the water management practices and reasons and lastly the crop choice and reasons for choosing certain crops.
6.2.1 Land management practices and reasons for doing these practices

In the table below (Table 2) the land management practices can be seen per community garden and what percentage of the interviewed people are doing a certain practice.

Table 2: Land management practices per community garden

<table>
<thead>
<tr>
<th>Land management practices</th>
<th>Banjulinding</th>
<th>Yundum</th>
<th>Marakissa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local fertilizer use (manure of cows, goats and chickens)</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Use of chemical fertilizer</td>
<td>90%</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>Use of chemical pesticides</td>
<td>95%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Use of black cover plastic</td>
<td>90%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Use of ashes</td>
<td>15%</td>
<td>50%</td>
<td>35%</td>
</tr>
<tr>
<td>Use of neem tree leaves</td>
<td>30%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Use of groundnut shells</td>
<td>0%</td>
<td>90%</td>
<td>5%</td>
</tr>
<tr>
<td>Use of dried leaves</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
</tr>
</tbody>
</table>
In the table below (Table 3), the main reasons which are mentioned for doing a certain land management practice can be seen in percentage of all the people doing a certain practice.

**Table 3: Main reasons mentioned by the interviewees for doing a certain land management practice**

<table>
<thead>
<tr>
<th>Land management practices</th>
<th>Main reasons</th>
<th>Percentage of people giving this reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local fertilizer use (manure of cows, goats and chickens) (total 61)</td>
<td>Otherwise crops do not grow, is how they always do it</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>No local fertilizer use because cannot afford local fertilizers</td>
<td>3%</td>
</tr>
<tr>
<td>Chemical fertilizer use (total 29)</td>
<td>Advice of the TTM</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>Crops grow faster</td>
<td>7%</td>
</tr>
<tr>
<td>Use of chemical pesticides (total 33)</td>
<td>Using it because of advice of ext. worker</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>Otherwise crops do not grow</td>
<td>3%</td>
</tr>
<tr>
<td>Use of black cover plastic (total 18)</td>
<td>To suppress weeds</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>To keep the water</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>Just always use it with tomato</td>
<td>77%</td>
</tr>
<tr>
<td>Use of ashes (total 25)</td>
<td>To prevent small insects from destroying the crops</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>To fertilize the soil</td>
<td>84%</td>
</tr>
<tr>
<td>Use of neem tree leaves (total 10)</td>
<td>Better than agro-chemical</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Use it when agro-chemical does not work</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>To stop small insects from damaging the plant and if there is a disease</td>
<td>100%</td>
</tr>
<tr>
<td>Use of groundnut shells (total 16)</td>
<td>To fertilize the soil</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td>Makes the soil ‘soft’</td>
<td>6%</td>
</tr>
<tr>
<td>Use of dried leaves (total 2)</td>
<td>No money for other types of fertilizers</td>
<td>100%</td>
</tr>
</tbody>
</table>

Almost all the women use local fertilizers, which consists of cow dung, goat dung and chicken dung. They collect it from fields around their houses. They learned this practice through transgenerational learning and by experience. The main reason which is mentioned is that without the use of fertilizer you cannot grow anything and this is just the way they do it.
The use of chemical fertilizer, or what the women in the gardens call the ‘European fertilizers’ are mainly being used because they learned about them through the TTM or from other types of projects, through agricultural workshops or from agricultural extension workers who advise them to use chemical fertilizers. The women say that it gives a higher yield if you use both local and other types of fertilizers.

The women who use chemical pesticides also learned it through these ways. The reasons mentioned for using the spray are mostly that it was being advised by agricultural extension workers. The women who use the black plastic to cover the soil learned this from the TTM. The main reasons they mention is that it suppresses weeds. Some mention that it keeps the water in the soil.

The practices of using ashes and using neem tree leaves as a bio-chemical are learned by the women through transgenerational learning and learning through experience. The reasons for using ashes are to keep small insects away and that it is good for the soil. The reasons for using the leaves of the neem tree are to stop small insects from damaging the plants and to stop a pest or disease if crops are affected. However, most of the women using this method actually prefer to use agro-chemical, but they chose this option because of a lack of money to buy agro-chemicals.

Groundnut shells are being used as a mulch and this practice is mostly learned through transgenerational learning, learning through experience and also through farmer-to-farmer learning. Their reasons to do this are to fertilize the soil and to make the soil ‘soft’.

The use of dried leaves was being done by two of the interviewed women. They were experimenting with this because they had no money for any type of other fertilizer.

6.2.2 Water management practices and reasons for doing these practices

In the table below (Table 4), the main reasons which are mentioned for watering the way they do can be seen.

**Table 4: Main reasons for the water management practices**

<table>
<thead>
<tr>
<th>Water management</th>
<th>Main reasons</th>
<th>Percentage of people giving this reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water use</td>
<td>Give crops as much water as possible</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td>Not watering daily because of a lack of water</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>Not watering daily because it is far away from their village</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Not watering daily because the crops don’t need that much water</td>
<td>5%</td>
</tr>
</tbody>
</table>

In the Banjulinding community garden, most of the people working here come every 3 days to water the crops. Because of a lack of water, there is a water rotation schedule where every row of water tanks get water every 3 days. When it is their turn to water, most of them water as much as possible. Some changed the crops because of the limited water supply (usually to tomatoes).
‘Before the water problem’, according to one interviewee in the Banjulinding garden (Interview 6, Banjulinding Community Garden, 25-03-2015); ‘around this time (end of March) the garden would be full with groundnut because it sells for the highest price.’

Some people make deals with their neighbouring group that they can take some water from them when there is no water in their tanks. Most of them say they just water as much as possible on the days they have water to overcome the days without water. Some people use plastic tubes for drip irrigation.

In the Yundum community garden most people water every day. In the Marakissa community garden some water as much as possible. Some of the women don’t water every day because they say that the crops don’t need water every day or because they live far away from the garden and cannot come every day. In these two gardens they water with buckets. In all of the three gardens, a part is not being used because of a lack of water.

6.2.3 Crop choice
In the table below (Table 5) the crop choice can be seen for the different community gardens.

Table 5: Crop choice in the different community gardens

<table>
<thead>
<tr>
<th>Crop choice</th>
<th>Banjulinding</th>
<th>Yundum</th>
<th>Marakissa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growing hot pepper</td>
<td>0%</td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>Growing other crops than hot pepper</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The crops being grown can be divided into two groups, one is the hot pepper which is being promoted through export companies doing projects in the gardens and other crops. The hot pepper is mainly being grown for export purposes (that is the plan at least, since both of the projects in the garden in Yundum and in Marakissa are just starting up). They learn how to grow hot pepper through teacher-student learning. The main reasons for choosing to either grow hot pepper or grow other crops can be seen in the table below (Table 6).
Table 6: Main reasons for choosing which crops to grow

<table>
<thead>
<tr>
<th>Crop choice</th>
<th>Main reasons</th>
<th>Percentage of people giving this reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growing hot pepper (total 14)</td>
<td>Market</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>Money</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>Project in the garden</td>
<td>57%</td>
</tr>
<tr>
<td>Growing other crops than hot pepper (total 61)</td>
<td>Market</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Upcoming Ramadan</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Money</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Because of water shortage</td>
<td>7%</td>
</tr>
</tbody>
</table>

The main reason for growing hot pepper is that there was a project on cultivating hot pepper in the community garden. Money and the market were also mentioned as reasons to grow hot pepper.

For growing other crops, money and the market were mentioned as a main reason by the women. These crops are mostly for local markets and a part for their own families. The Ramadan and market prices are the main reasons for growing these crops. As one interviewee in the Yundum garden explained: ‘I grow onion because Gambians like onions too much. You know you get money there.’ (Interview 2, Yundum Community Garden, 02-04-2015). Transgenerational, experience and farmer-to-farmer learning are the main ways in which the women learned how to grow these crops. In the gardens they have four to six growing cycles, depending on which crops they choose to grow.

6.3 Learning
Here the second sub-question; ‘Where and how did they learn about these practices?’ will be assessed, first the main ways of learning per community garden, then the role of extension workers in the gardens, the way of learning for land management practices, water management practices and crop choice and something about other actors involved in knowledge generation in the gardens.

6.3.1 Main ways of learning per community garden
In the table below, the main way of learning mentioned by the women working in the community gardens can be seen (Table 7).
Table 7: Main ways of learning per community garden

<table>
<thead>
<tr>
<th></th>
<th>Banjulinding</th>
<th>Yundum</th>
<th>Marakissa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher-student learning</td>
<td>35%</td>
<td>0%</td>
<td>6%</td>
</tr>
<tr>
<td>Trans-generational learning</td>
<td>10%</td>
<td>45%</td>
<td>28%</td>
</tr>
<tr>
<td>Farmer-to-farmer learning</td>
<td>10%</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>Learning through experience</td>
<td>45%</td>
<td>35%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Banjulinding
The main source of knowledge mentioned by interviewees in Banjulinding comes from experience (45%) and from teacher-student learning (35%). The teacher-student learning is mostly from the TTM and from extension workers. Farmer-to-farmer learning and transgenerational learning are both mentioned by 10% as their main source of knowledge.

Yundum
In the garden in Yundum, the most important way of learning mentioned by the interviewees is trans-generational learning (45%) and learning through experience (35%). As one interviewee typically said: ‘They are all farmers (her family). Even my mother, she is too old but she is still farming.’ (Interview 18, Yundum Community Garden, 24-04-2015).

Farmer-to-farmer learning accounts for 20% and no one mentioned teacher-student learning as a main source of knowledge.

Marakissa
The most important way of learning in the Marakissa community garden is learning through experience. Trans-generational learning is mentioned by 28% of the interviewed women as the most important source of knowledge, farmer-to-farmer learning by 17% and teacher-student learning by 6% (Fig. 5). One woman who said to have learned mostly through farmer-to-farmer learning (or from friends in the garden to use their words) was saying that ‘The village where I came from we only grow onions, but I learned how to grow other crops from my friends. The garden in my village had no fence, so sometimes animals would come and eat the crops. But now I can sleep in peace because she knows that no animals will come in.’ (Interview 13, Marakissa Community Garden, 14-04-2015).

6.3.2 Role of extension workers
By interviewing the extension worker in the Banjulinding garden and the extension worker in training in the Marakissa garden, a difference could be seen in the way they work. The one in Banjulinding was mainly advising women to use agro-chemicals. The extension worker in Banjulinding: ‘I walk around and see if there are any problems. Diseases and pests. First I tell them to spray chemicals and if that doesn’t work, I tell them to uproot the crops so that it does not spread.’ (Interview Agricultural Extension Worker, Banjulinding Community Garden, 30-03-2015).
This was also shown by answers from interviewees, as one interviewee said: ‘When I need advice I go to the agricultural extension worker and she tells me which chemical to apply.’ (Interview 9, Banjulinding Community Garden, 25-03-2015).

The extension worker (who was still in training at the time of research) in Marakissa was facilitating weekly meetings. The extension worker in training: ‘I organise meetings. The women exchange the difficulties they face. For instance now a lot of people have a disease in the onions. Sometimes I go around and advice people on for instance how much fertilizer they should apply.’ (Interview 14, Marakissa Community Garden, 15-04-2015). None of the extension workers were working with experimenting with different crops or different practices. In the Yundum garden an extension worker sometimes came by, but he/she did not seem to play an important role in the garden since only some women mentioned it and no one knew when the extension worker would come again.

6.3.3 Way of learning per practice

Way of learning and land management practices
In the table below (Table 8), the way of learning can be seen per land management practice for the three community gardens.
Table 8: Main way of learning on the different community gardens per land management practice

<table>
<thead>
<tr>
<th>Land management practices</th>
<th>Main way of learning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Banjulinding</td>
</tr>
<tr>
<td>Local fertilizer (manure of cows, goats and chickens)</td>
<td>Experience</td>
</tr>
<tr>
<td>Chemical fertilizer</td>
<td>Teacher-student learning from extension workers</td>
</tr>
<tr>
<td>Chemical pesticide</td>
<td>Teacher-student learning from extension workers</td>
</tr>
<tr>
<td>Black cover plastic</td>
<td>Teacher-student learning from TTM</td>
</tr>
<tr>
<td>Ashes</td>
<td>Experience</td>
</tr>
<tr>
<td>Use of neem tree leaves</td>
<td>Experience</td>
</tr>
<tr>
<td>Groundnut shells</td>
<td>-</td>
</tr>
<tr>
<td>Dried leaves</td>
<td>-</td>
</tr>
</tbody>
</table>

A clear difference can be seen in the ways of learning between traditional practices and non-traditional practices. The traditional practices here are the use of local fertilizer, use of groundnut shells and the use of the leaves of neem trees. These practices have all mainly been learned through transgenerational learning and learning through experience. The non-traditional practices are the use of chemical fertilizers, of chemical pesticides and the use of black plastic to cover the soil. These practices have been learned through teacher-student learning from the TTM, agricultural workshops or extension workers. It differs per garden to what extent they use traditional or non-traditional practices. In the community garden in Banjulinding, the use of non-traditional practices is higher than
the other gardens. This is due to the presence of the TTM since they introduced most of these practices. The use of local practices is highest in the garden in Yundum. This is probably due to the fact that all of the women are from the Yola tribe, which is the tribe in The Gambia who is most involved in agriculture. There is a high rate of women who have a lot of experience and whose parents were also involved in farming.

**Way of learning and water management practices**

The water management practices of the interviewees were learned mostly through experience and transgenerational learning. There is no teacher-student learning taking place on water management practices in the gardens.

**Way of learning and crop choice**

In the table below (Table 9), the way of learning can be seen in relation to the crop choice for the three community gardens.

Table 9: Main way of learning in relation to crop choice

<table>
<thead>
<tr>
<th>Crop choice</th>
<th>Main way of learning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Banjulinding</td>
</tr>
<tr>
<td>Growing hot pepper</td>
<td>-</td>
</tr>
<tr>
<td>Growing other crops than hot pepper</td>
<td>Teacher-student learning</td>
</tr>
</tbody>
</table>

Growing hot pepper is mainly learned through teacher-student learning. Other crops being grown is mostly learned from teacher-student learning in the community garden in Banjulinding, transgenerational learning in the Yundum community garden and through experience in the Marakissa community garden.

**6.3.4 Other actors involved with knowledge generation**

**Collaboration with the TTM**

In the past, the TTM introduced new practices, improved seeds and other methods. The influence of this is still clearly visible in the Banjulinding community garden. But the issue with these kind of collaboration or support from outsiders is that when the project is finished, the women find themselves left in the garden with the things they learned, other crops, other practices, but without the financial support from these projects. So what can happen then, as can be seen in the Banjulinding community garden, is that they still try to do the practices they learned (using black cover plastic, buying fertilizers, seeds, agro-chemicals) but due to a lack of money they struggle to do this because the investment costs are higher compared to when they would use more local methods.
Projects on cultivating hot pepper

In the community garden in Yundum and the one in Marakissa, there is a project from a company working on teaching the women how to grow hot pepper for export. This could be a good opportunity for the women to enhance the profitability, but during interviews it also became clear that the women were often working on the land to grow hot pepper without knowing what they would get for it in return. The women should not be used for cheap labour, using their land and water resources without clear benefits. It could be a good development to start to link to export markets, but the hot pepper that was being grown with the projects was with the use of chemical fertilizers and chemical pesticides which were provided by the project for now, but which could be an obstacle for the women when the project leaves the garden.

NARI National Agricultural Research Institute

Apart from the agricultural extension workers, there is the NARI doing research on agricultural practices. An interview has been conducted with the head of the NARI (Interview head of the NARI, NARI office, 31-03-2015). The NARI is the National Agricultural Research Institute of The Gambia. It is an institute created by government, now it is semi-autonomous and it gets some support from donors. It has a research site right next to the Banjulinding garden, but there is no collaboration between them. The NARI does research into vegetables, fruit trees, roots and tubers and some plantation crops (banana and plantain). Its’ main focus is to develop a technology for farmers to adopt at low cost. They are currently working on the introduction of new varieties of crops; mainly looking at pest and disease problems. They are trying to find a new variety of onion that can be grown in the rainy season because the variety which is being used now cannot stand the high humidity and it is too wet.

The new technologies in which they are looking into are for instance using organic manure. According to their research, it stays longer in the soil than other types of manure and improves the water holding capacity of the soil. They share their knowledge with farmers through on-station trials; on farmer fields where many people pass. They call farmers to come and show them. Farmers then try themselves and give them feedback on how it worked for them. They call their type of research adaptive research.

The NARI is working with one community garden in another village. There they are looking at efficiency of water in drip irrigation vs supplying water with the buckets from the well. They encourage mulching and the use of organic manure. Mulching keeps water in the soil, it improves the water holding capacity. They advise to mulch with dry grass, it decays and replenishes your soil. They work together with extension workers everywhere they work. It is really necessary to involve them, you have to pass through them. They are the change agents, the forefront of change. Some are very willing to help, others don’t and that can make it very difficult. The NARI focusses on crops for own consumption, and to sell the excess.

According to a study done by Sanyang (Sanyang Et. al.,2009), the NARI has a potential role to play in the community gardens, but it is poorly equipped and poorly finances to develop sustainable practices on a routine basis.

6.4 Sustainability

In this chapter the third sub-question; ‘How sustainable are these practices?’ will be assessed. First the aspects of sustainable land management will be discussed; less use of external input, using improved management techniques and using the resources efficiently will be looked at. Then an assessment of the sustainability of the land management practices being done in the gardens will be
done based on the aspects of sustainability described above. The same will be done for sustainable water management. After that the local sustainability and economic viability will be assessed since those are important to understand the reality of the ones working in the community gardens.

6.4.1 Land management

6.4.1.1 Aspects of sustainable land management
An overview of the different aspects related to sustainable land management can be seen in the figure below (Fig. 3). When looking at sustainable land management in these community gardens the aspects which have been assessed are less use of external input (indicated in Fig. 3 by the darker blue box), thus if it has a local source or not; if it is an improved management technique (the lighter blue boxes) that increases water holding capacity, decreases (evapo)transpiration and/or if it increases the soil fertility; and for the efficiency of the practice (the orange boxes) the time and money investments are taken into account.

![Figure 3: Different aspects related to sustainable land management](image)

6.4.1.2 Sustainability assessment of land management practices
In the text below, the different land management practices will be assessed on their sustainability according to the indicators described in the figure above (Fig. 3).

*Local fertilizer*

*Less use of external input*

Local fertilizers are locally available, the women usually collect the cow/goat/hen dung themselves to use it in the community gardens.
**Improved management techniques**

The use of local fertilizer increases the soil fertility and with that it also increases the water holding capacity, because there is more life in a fertile soil, thus more humus and more soil life which are good for the water holding capacity (Haynes and Naidu, 1998).

**Efficiency**

It does take time for the women to collect the local fertilizers. Sometimes they do not have to pay for it because it is being collected from the field, but this is not always easy to do because sometimes people pay the Fula tribe (the cow herders) to let the cows on their land for one day and night to fertilize the land and the women are often actually not allowed to take the dung. Some women burn the dung before applying it on their plots.

**Chemical fertilizer**

**Less use of external input:** Chemical fertilizers have to be bought in shops and are not locally produced. They often come from Europe and therefore some women also call it the ‘European fertilizer’.

**Improved management techniques**

The use of chemical fertilizer increases the soil fertility and water holding capacity. However, agro-chemicals can cause soil pollution and it can deteriorate water resources (Tonderski, 1996).

**Efficiency**

The time investment is to buy the fertilizer and apply it on the fields. It costs money, which is a problem for some of the women.

**Chemical pesticide**

**Less use of external input**

Chemical pesticides also have to be bought in shops and are not locally produced.

**Improved management techniques**

The use of chemical pesticides decreases the loss of crops due to pests and diseases. But the same as the chemical fertilizer, it can cause pollution of the soil and water bodies.

**Efficiency**

The chemical pesticide has to be bought but the application is fast, since it is often applied with a spray pump.

**Black cover plastic**

**Less use of external input**

The black cover plastic has to be bought and is not locally produced

**Improved management techniques**

Covering the soil with black plastic can enhance the water holding capacity and decrease the evaporation of water from the soil. It also decreases weed growth. It is however not used for all the crops, only for tomatoes, cucumber and sometimes eggplants.

**Efficiency**
The black plastic has to be bought and it takes time to put it on the field.

**Ashes**

**Less use of external input**

Ashes are being made from burning wood or burning crop residues and it is therefore a local source.

**Improved management techniques**

The women who use ashes call it both a fertilizer and an insect repellent. It has been shown in studies that the application of ashes can increase the nutrient uptake and the crop yield (Mitra et al., 2005). Another study has shown that in Nigeria ashes are commonly used for protecting cowpea and groundnut against storage pests (Poswal et al., 1991). However, the effect of ashes are dependent on the type of soil and soil properties which makes it difficult to know effect of this practice (Demeyer et al., 2001)

**Efficiency**

It does not cost any extra money for the women to use ashes, it just takes time to burn the wood or crop residues from the field and to apply it.

**Leaves of neem tree**

**Less use of external input**

The neem trees grow in the Gambia and close to the Banjulinding and Yundum community gardens there is at least one tree which the women sometimes use, so it is locally available.

**Improved management techniques**

Some women use the leaves of the neem trees are pounded and mixed with water to spray on the crops. It works as a bio-pesticide, insecticide and agro-chemical. (Inglis et al., 1993). Close to the Banjulinding and the Yundum gardens there are neem trees which they use. In literature the neem tree is praised for its potential as a wonder tree because of its utility in agriculture (Brahmachari, 2004), but despite that there are not that many people in the gardens using it. Chemicals are used more than extracts of neem leaves. One interviewee said that ‘local medicine (extract from neem tree leaves) is better than chemicals, but I would buy chemicals if I have the money for it’ (Interview 15, Yundum Community Garden, 23-04-2015). Another interviewee said that she preferred to ‘use chemicals because once it happened to someone that her onions became bitter after applying the neem extract.’(Interview 20, Yundum Community Garden, 25-04-2015).

**Efficiency**

It does not cost money, but it requires a time investment to collect the leaves and make a mixture of it.

**Groundnut shells**

**Less use of external input**

Groundnut shells are widely available in The Gambia because of its widespread groundnut production.

**Improved management techniques**

The use of groundnut shells is good for the soil fertility and it can increase the water holding capacity (Reneau et al., 1980; et al., 1971). However, there are also studies that say that groundnut shells can
contain weed seeds and nematodes, so they recommend other types of mulching material (Black et al., IFAS).

**Efficiency**

The groundnut shells are mostly used in the Yundum community garden and are bought collectively in a large quantity. The application does not take that much time.

**Crop choice**

The crop choice in the gardens is mainly guided by the market prices. Only three people mentioned that they chose to grow a certain crop because it could still grow well with less water. Every year, there are round 4-6 growing cycles, dependent on the crops which are being grown and how long their growing period takes. There is a clear difference in the type of crops being grown in the rainy season (rice, maize and groundnut) and in the dry season (onions and other vegetables). This can be beneficial for the land, since every crop requires slightly different amounts of nutrients and have different rooting systems and rooting depths which can prevent the soil from being depleted. Groundnut is a nitrogen-fixing crop, which is good for getting more nitrogen in the soil (McDonagh et al., 1993).

6.4.1.3 Overview

In the table below (Table 10), some important aspects that relate to the sustainability of a practice can be seen per practice. The main practices that have been found to be used in the three gardens can be seen here. A + or ++ means that it is beneficial and a - or -- means that it is not beneficial. If there is no influence of the practice on a certain aspect of sustainability, there is nothing in the table. The soil fertility, water holding capacity and (evapo)transpiration have been chosen as physical aspects of sustainable land and water management practices, thus the improved management techniques. The dependency on external inputs and efficiency (in terms of the price of a certain practice and the time investment needed) have also been taken into account. The efficiency of land management practices has to do with the time and money investments needed and the return in terms of sustainable land management; increased soil fertility, increased water holding capacity. The decreased risk of pests and diseases and decreased weed growth have also been taken into account since they are directly related to the crop yield and important factors that relate to land management techniques.
Table 10: The sustainability of practices being done in the community gardens

<table>
<thead>
<tr>
<th>Sustainability indicators</th>
<th>Local fertilizer</th>
<th>Chemical fertilizer</th>
<th>Black cover plastic</th>
<th>Ashes</th>
<th>Leaves of neem tree (bio-pesticide)</th>
<th>Groundnut shells</th>
<th>Chemical pesticide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Efficiency:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price of practice</td>
<td>++</td>
<td>--</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>Time investment</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><strong>Improved management techniques:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased soil fertility</td>
<td>++</td>
<td>++</td>
<td>--</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Increased water holding capacity</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased (evapo) transpiration</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Less use of external input</strong></td>
<td>++</td>
<td>--</td>
<td>-</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>--</td>
</tr>
<tr>
<td>Decreased (risk of) pests/diseases</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>Decreased weed growth</td>
<td>--</td>
<td>--</td>
<td>++</td>
<td>+</td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Some practices are cheap, like the local fertilizer, but the women do have to invest time to collect the local fertilizers (cow, goat or hen dung). The chemical pesticide for instance is expensive, but is does decrease the (risk of) pests and diseases. Looking at this table, the practices of using ashes and groundnut shells are quite sustainable practices, since they are locally available, they both increase the soil fertility and decrease weed growth (because of the soil cover it provides). Water holding capacity increases with the use of groundnut shells and ashes decrease the risk of pests and diseases. Apart from that, they are also relatively cheap and don’t require a high time investment.

6.4.2 Water management

In the text below, the water management practices will be assessed and the sustainability of them. First, the aspects which are important in community gardens for sustainable water management will be explained, then the practices will be assessed on their sustainability according to these aspect.

6.4.2.1 Aspects of sustainable water management

In the figure below, the aspects related to sustainable water management can be seen (Fig. 4). The aspects taken into account are less use of external input (the darker blue boxes), improved management techniques (the lighter blue boxes) and efficiency (the orange boxes). For less use of external input it has been assessed whether the water comes from a local source, if the energy
needed to pump up water comes from a local source and if the ones working in the gardens are dependent on others for maintenance of the water system. For improved management techniques, important factors are if a certain management technique increases the water holding capacity. If it decreases (evapo)transpiration and/or if there is an efficient water application. For efficiency, the time (hour of the day) of watering has been taken into account and the money and time investment needed (Fig. 4).

![Diagram of sustainability aspects](image)

**Figure 4: Different aspects related to sustainable water management**

6.4.2.2 Sustainability assessment of water management practices

In the text below the water management practices will be assessed according to the aspects of sustainable water management described in the figure above (Fig. 4). The water application and knowledge of the women on water management will also be discussed.

**Use of solar panels for pumping up water**

**Less use of external input**

The energy source for using solar panels is local, as well as the groundwater being pumped up. However, for maintenance of the solar panels people from outside are needed and the gardens who have solar panels need a guard to make sure they don’t get stolen (which has happened in the Yundum community garden). The issue here is that these watering systems have been sponsored by either the government or another organisation which have now retreated, so the gardens will be in a difficult position if the water system or solar panels have to be repaired. This decreases their resilience against periods of drought and a failing water system.
Improved management techniques

It is an improved management technique, because it makes it easier for the women to apply water since the water is pumped to different water tanks from which the water is being taken.

Efficiency

It is efficient because there is no extra money investment needed after the solar panels have been placed (apart from maintenance costs). It also requires less time to water than when local dug-out wells are being used from which the women have to lift up the water.

However, an issue here is that the time of watering is influenced by how the solar panels have been positioned, so when water is being pumped. In the Yundum garden they women have to water in the afternoon because of this, which is not ideal.

Use of electricity grid for pumping up water

Less use of external input

The water which is pumped with electricity from the electricity grid has its downside that it is not always working, sometimes there is no electricity for a part of the day or even some subsequent days. The water is groundwater, thus a local source. The same holds here as described above, that maintenance of the watering system can be a problem in the community gardens.

Improved management techniques

Using the electricity grid for pumping up water is an improved management technique, because it makes it easier for the women to apply water since the water is pumped to different water tanks from which the water is being taken.

Efficiency

Using the electricity grid in The Gambia works by buying ‘cash power’, which means that you have to go to an office of the electricity company to buy credit to use the electricity grid. It can be difficult in the community gardens to arrange that moneywise, because every once in a while money has to be collected again to buy the cash power, and there are always people who have difficulties with paying these fees as was also observed in the Marakissa community garden, where a meeting was being held because they had run out of cash power, leading to discussions about paying the fees. Using the electricity grid to pump up water requires less time to water than when local dug-out wells are being used from which the women have to lift up the water.

Drip irrigation

Less use of external input

Drip irrigation is used in some parts of the garden where the project on growing hot pepper is working since they want to promote new technologies. An external party has to install drip irrigation, since the women working in the gardens do not have the means to do that. It could be an issue later on when the project has left again and the maintenance is left to the ones working in the gardens.

Improved management techniques

It is an improved management technique because it decreases the (evapo)transpiration because water is being applied only close to the crops and not on the whole bed. It is a more efficient use of the water. However, what was observed in the gardens on the parts where drip irrigation was being
used, no mulch material or other improved land management techniques were being used, the soil was bare.

**Efficiency**

It is more efficient than other watering techniques because it makes watering easier for the women, it requires less work, the time of watering is not that important anymore because it is less physical work. It does require a money and time investment to create a drip irrigation system.

**Water application and knowledge**

**Water application**

The use of improved management techniques for sustainable water management is minimal in the gardens. Efficient water application is not being practiced in the gardens. Most of the women in the gardens water as much as possible when there is water. Watering is mostly done with buckets, taking water from the water tanks with buckets and empty the buckets on the plots. Watering as much as possible is of course understandable from their point of view; if there is water, make as much use of it as you can. Only three women mentioned that they water less because the crops don’t need water every day. The women in the gardens do not differentiate for different crops, in general all the crops get the same amount of water. From a point of view of sustainable land and water management, this is not the best way to go because now water is being wasted on crops that don’t need that much water, and other crops do not get enough water and they die.

**Knowledge on water management**

In all of the gardens water is a limiting factor for producing crops. However, by doing interviews it became clear that there is no real knowledge present in the gardens on how much water is available and how much should be used. There are some improved management techniques being done, such as mulching with groundnut shells and covering the soil with black plastic which both enhance the water holding capacity, but this is not being done by everyone and not included by extension workers on what they teach the women. There is also no conscious use of the water and no knowledge generation on how to limit water use or how to deal with water stress.

**6.4.3 Local sustainability**

In the local language of the Yola people who are mostly involved in farming, ‘sustainability’ is translated as ‘Paniji ngoter joken beh nuano sani’. The literal translation to English is ‘you can own it for the future’ (Interview with Lamin, Marakissa, 14-04-2015).

The word sustainability can often not be literally translated to different languages. It is therefore difficult to ask directly about it, because the answers you will get do not directly relate to the question you want to ask because of a different perception of the meaning of it. How the word sustainability is translated in different languages reflects the way they perceive sustainability, what is important for them when they think about sustainability. Sustainable development is a local practice because every community has different needs and different quality of life concerns (Maida, 2007).

The women working in the gardens are mostly just trying to manage. That is also implied with the translation of sustainability in their local language. The limited amount of water, the small beds, the work it takes, diseases in the crops and for some the lack of money to buy fertilizers/ agro-chemicals makes it difficult to get something from it. However, even under these circumstances the women say that it is their only hope, the only way to sustain their family and to make sure that their children can go to school. As one interviewee was saying: ‘I need the money to buy rice. I also pay the school fees with the money I get in the garden. But the problem now is to buy rice’ (Interview 5, Marakissa)
Sustainability for them is more an issue of getting through the day, trying to make sure that their crops don’t die. However in some way they have a long-term perspective, because they come every day to water the beds they have for a small return. But the Gambia has a limited amount of jobs, especially for women, so working on a community garden makes a huge difference for them. The difference is being able to send their kids to school, which is really important for the development of the children and through that the development of the Gambia.

The factors which relate to the local sustainability are the time they have available, the time they need to spend on planting, weeding, watering, fertilizing and other practices such as applying groundnut shells and ashes and the costs for input products. Since The Gambia is a country where traditional man-woman roles are still very much present, the women also have to balance their time between household work and working in the gardens. They need money for becoming part of the garden, staying in the garden, for water, seeds and agro-chemicals.

The physical work load is also an important factor since the climate in The Gambia can get very hot and tough to work in. The return is the crops they use for consumption for their own families and the money they get from selling the crops. Resilience from the point of view is that they are able to cope with periods of drought, of failing water supply, of increase in input prices and a decrease in the output, both in terms of crop yield and market prices. The way to deal with this is to have local connections (both bonding, bridging and linking social capital) and a certain independence of outside factors.

### 6.4.4 Economic viability

A main issue when looking at these community gardens is the profitability of it. For the women working in these gardens, it is mainly a question of managing, of balancing between the costs of seeds, fertilizers, groundnut shells, agro-chemicals, the fees they have to pay for the water and the watchmen and what they can produce for their own families and for the local markets. During the interviews, a lot of women were talking about these kind of things. To illustrate this; during interviews in the Marakissa community garden, one woman called us (myself and the translator) to see her crops. She was telling us that ‘The onions have a disease, they (agricultural extension workers) tell me to spray chemicals but I don’t have the money.’ (Interview 21, Marakissa Community Garden, 20-04-2015).

It is a fine balance, which makes it difficult for the women to experiment with different crops or different practices, because there is not much room for not getting anything in return for their work. They also put quite some time in it.

The other side of it is that it is maybe one of the few options they have for getting some sort of income, as most of the women have a low educational level. Even though the circumstances might be difficult and they produce little in terms of agricultural production, it is a very important source of income for them. Almost all of the women are able to pay school fees for their children because of their work in the community gardens. As some of them said, ‘it is their only hope’.

Their ways of dealing with this profitability issue are that some of them diversify the type of crops they grow, they have some other source of income and they work together with other women. In the gardens in Banjullinding and Yundum there is a place to store the crops and people can come to the garden to buy the crops. In Marakissa, there are three women who collect the crops from the women and sell them at local markets. Working in community gardens is what they know, and some women
mentioned that ‘they know what they have here in the garden’. It is a relatively stable source of income, if they take care of their crops, they will at least get something from it. How easy or how difficult it is to sell the crops is very much dependent on the location of the community garden. The Banjulinding garden is next to the main road between Serekunda and Brikama, two of the largest cities in The Gambia. There is a small stand on the side of the road where women sell some of their produce, and it is easy for others to go into the garden and buy larger quantities to sell at local markets. This is more difficult for the other two gardens. The one in Yundum is still quite close to Lamin, but the garden in Marakissa is not close to any larger market so they have some women there who take the vegetables to local markets.

There is a lack of investments in watering systems, fences, of any kind of support in these gardens. All of these three gardens had a sponsor at some point, but at the time of research there were no sponsors anymore. There is a research institute, but it is poorly equipped and poorly finances to develop sustainable practices on a routine basis (Sanyang Et al.,2009). The problem with these things is who is supposed to invest in it? The government, with their slogan to ‘grow what you eat & eat what you grow’ seems an obvious answer, but that will be difficult as The Gambia is among the poorest countries in the world; although the president belongs to some of the richest. But being critical about the way the president is governing the country is a no-go area for Gambians. As Smith said in an interview done by the Guardian: ‘The Gambia is a veritable black hole for human rights.’ (Allison, 2015).

6.5 Relation between learning, circumstances, social capital and practices
The fourth sub-question; ‘What is the relation between the type of learning, circumstances, social capital and land and water management practices on the community gardens?’ will be assessed below; first with an overview and then on how the different fields of learning, practices, circumstances and social capital influence each other.

6.5.1 Overview
Presented below (Fig. 5) is a figure of the different types of learning, different types of knowledge, land and water management practices, circumstances and social capital that influence the land and water management practices of the ones working in the gardens as it was found during this study. In the text below the figure these links will be explained; how social capital relates to the way of learning, how the way of learning relates to the type of knowledge, the land and water management practices and their sustainability, how circumstances influence land and water management practices, how social capital influences land and water management practices in the gardens and how this relates to the crop yield and the purpose of these crops.
Figure 5: Different types of learning, of knowledge, land and water management practices and circumstance
6.5.2 Social capital and way of learning

The bonding, bridging and linking social capital are all important in both the learning process. In the figure above (Fig. 5) this is indicated by the red boxes.

The bonding and bridging social capital also relates to farmer-to-farmer learning; the higher the bonding and bridging social capital the higher the farmer-to-farmer learning. Transgenerational learning is influenced by bonding social capital since knowledge is transferred from generation to generation and for that to happen bonding social capital is needed.

The linking social capital relates to teacher-student learning, because the transferring of knowledge comes from other actors such as extension workers, and for that links with the agricultural department are needed. In the table below (Table 11), the social capital can be seen per community garden compared to the other gardens, thus if it is higher, in between or lower than the other two.

Table 11: Social capital in the community gardens

<table>
<thead>
<tr>
<th>Community Garden</th>
<th>Bonding social capital</th>
<th>Bridging social capital</th>
<th>Linking social capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banjulinding</td>
<td>Medium</td>
<td>Medium</td>
<td>Highest</td>
</tr>
<tr>
<td>Yundum</td>
<td>Highest</td>
<td>Highest</td>
<td>Medium</td>
</tr>
<tr>
<td>Marakissa</td>
<td>Lowest</td>
<td>Lowest</td>
<td>Lowest</td>
</tr>
</tbody>
</table>

In the Banjulinding community garden the bridging social capital can be seen by looking at the relations between the different groups. Something mentioned in the Banjulinding community garden was that sharing knowledge among different groups, thus farmer-to-farmer learning was sometimes difficult because of competition between the groups. This can also lower bonding social capital. The teacher-student learning in Bajulinding is higher and they have more connection with the agricultural department and universities/colleges compared to the other two gardens the linking social capital is higher.

The Yundum community garden has got higher rates of farmer-to-farmer learning and transgenerational learning compared to the other two gardens. The bonding and bridging social capital is therefore higher.

In the Marakissa community garden the bonding social capital is lower since it is a mix of women from different villages and tribes. The linking social capital is also lower compared to the Banjulinding garden.

6.5.3 Ways of learning and knowledge

Knowledge about newer technologies

In this study, it has been found that of the different ways of learning, teacher-student learning, learning through experience and farmer to farmer learning, which are indicated in the figure above by the light blue boxes (Fig. 5), relate to knowledge about newer technologies (which are not traditional). The knowledge about newer technologies (the blue box in Figure 5) relates to the use of black cover plastic and the use of agro-chemicals and it influences the crop choice, both local crops and the choice for growing hot pepper as an export crop. Learning through experimenting is almost not present in the gardens, and therefore not taken into account in this diagram.
Traditional knowledge

Learning through experience, farmer-to-farmer learning and transgenerational learning relates to traditional knowledge. The traditional knowledge relates to the use of groundnut shells, of local fertilizers and bio-pesticides and the choice of local crops (all except hot pepper).

6.5.4 Land and water management practices and sustainability

Sustainability

All the boxes in green (Fig. 5), thus the land and water management practices being practiced in the gardens and they are related to the sustainability of the gardens.

The factors which are related to the local sustainability are the input of the women working in these gardens; their time and money, and the output on terms of the crops they produced for either consumption for their families, for selling on local markets or for export purposes. In the diagram (Fig. 5) this has been indicated with the round boxes.

Why certain practices are being done

The arrows in the diagram indicate that one thing influences something else. It differs per person to what extent one thing influences the other and which ‘route’ they take. The type of learning and the circumstances are of great influence on the knowledge, and therefore their practices. However, in the different gardens, different practices are more dominant. This is due to both the type of learning, the circumstances and the social capital in the gardens.

6.5.5 Circumstances and land and water management practices

There are some circumstances which relate to the use of certain practices. These are the lack of money for agro-chemical fertilizers and agro-chemicals, limited time availability, diseases and pests in crops, limited water availability and other projects in the garden (in this case projects on growing hot pepper). In the figure the circumstances which influence land and water management practices have been indicated with the purple boxes (Fig. 5). Social capital also plays a role in this but that will be discussed later on.

Lack of money

The lack of money relates to more use of local fertilizers and the use of bio-pesticides.

Diseases and pests in crops

Diseases and/or pests in crops can lead to the use of agro-chemicals or the use of a mixture with neem tree leaves to get rid of the disease and/or pest. It also influences the crop choice, because sometimes a crop is not being planted because there is a disease or pest in that crop which make the women choose to grow another crop. It can also be that crops die because of diseases/pests and then also different crops will be planted.

Limited time availability

One of the constraints that play an important role in sustainable land and water management is time. Most of the women spend a lot of time in the gardens because the watering, weeding, preparing the beds, seeding etc. is all done by hand and it takes a lot of time. Physically it is also hard work (Vanderwal et al., 2009), especially in the hot climate of The Gambia. Apart from that, the women are mostly also responsible for the household tasks, preparing food and cleaning. Some live far away from the community garden and have to walk from their home village. From the
interviewees, some women said they could not come every day because it is far away. Other research has already shown that some practices are difficult to introduce in community gardens in The Gambia, because they take more time from the women which they do not always have (Baker and Edmonds, 2004). One research paper on women’s gardens in The Gambia even refers to the gardens as being ‘second husbands’ and that the gardens are in a way competing with their real husband in terms of work and time (Schroeder, 1996).

The limited time availability relates to the use of agro-chemicals, since they are easier and quicker to apply than collecting local manure or preparing the bio-pesticide. It also relates to the water management practices of how often the women water. Some women do not have that much time so they cannot come to the garden every day, and when they are in the gardens they water as much as possible.

**Limited water availability**

The limited water availability relates to the water management practices and to the crop choice. Because of the limited water availability, most women water as much as possible when there is water. It also influences the crop choice, since some crops can grow better with less water than other crops. Sometimes crops die because of a lack of water, and then also other crops are being grown.

**Other projects in the community garden**

In some gardens there is a project going on about growing hot pepper for export. This influences the crop choice to grow hot pepper, since it is being supported by the project and often seeds and other input material is being supplied to the women.

**6.5.6 Social capital and land and water management practices**

The bonding, bridging and linking social capital are important for if certain practices are being done or not, because of the collective action (Krasny and Tidball, 2009). The social capital is indicated by the red boxes in the figure above (Fig. 5).

**The role of bonding social capital**

Bonding social capital is highest in the Yundum community garden because of the way the garden started. It started with a group of women collecting money together by working on farms and buying a piece of land together to start a community garden, after which more women joined. Thus there are more close links between people because of them being family members, friends or being from the same tribe.

In the Marakissa community garden, the bonding social capital is lower because there are more women in the garden and they come from different villages and from different tribes. This can make it more difficult for them to for instance collaborate on buying groundnut shells or preparing the mixture of neem tree leaves to use on their beds.

The Banjulinding community garden has more people than the other two gardens which can make the bonding social capital lower.

**The role of bridging social capital**

Bridging social capital plays a role in links between people within the community gardens who otherwise are not connected to each other by for instance being family members of each other. Bridging social capital is important to collaborate on buying groundnut shells or preparing the mixture of neem tree leaves to use on their beds.
In the Banjulinding community garden the women mostly work together in groups of 5. There can be some competition between the groups which makes it more difficult to have a strong bridging social capital.

It is cheaper and easier to buy groundnut shells in collaboration, which was observed in the community garden in Yundum which was the only community garden where most of the women used groundnut shells. The same holds for the use of bio-pesticides, since it is easier to do this in collaboration with each other.

In the Marakissa community garden, the bridging social capital plays a more important role because the women working there come from different villages and from different tribes. There are weekly meetings which could improve the bridging social capital.

The role of linking social capital
Linking social capital is important for external knowledge generation; the teacher-student learning. The links with other organisations is an important aspect because of money needed for investments for the water system, in fences or for input costs.

Of the three gardens, the Banjulinding has most links with others on a higher level than the other community gardens. This is the case because of their past collaboration with the TTIM and being known as the oldest community garden in The Gambia, and having links with colleges and the university.

6.5.7 Crop output
The crops produced are either used by the women for consumption for their own families, sold on local markets or exported, indicated in the figure by the orange boxes (Fig. 5). The water management practices together with the crop choice for local crops relates to the crops being sold on local markets and crops being used for their own consumption. The hot pepper crop choice and water management practices relate to the crops being used for export. All the land management techniques also relate to the crop yield because of the soil fertility, diseases and pests and water availability.
7. Discussion

The main research question; ‘What are the possibilities and constraints for sustainable land and water management in terms of learning and practices on community gardens in The Gambia?’ will be discussed below according to the findings on the three community gardens in The Gambia. What will be discussed is; the learning process and land and water management practices, sustainability and land and water management practices, circumstances and social capital.

7.1 Learning and land and water management practices

7.1.1 Learning

Learning, or knowledge generation, is a catalyst for getting to more sustainable community gardens. Of the different ways of learning in the gardens, there are three which can be changed; teacher-student learning, farmer-to-farmer learning and learning through experimenting. Currently, the teacher-student learning taking place is mostly through extension workers and projects in the gardens. There are different ways in which teacher-student learning can be done. It can simply be the transferring of knowledge, but they can also be a facilitator of the learning process in farmer-to-farmer learning or experimenting, thus in that way creating a continuous knowledge generation system. The farmer-to-farmer learning is present, but can be enhanced. Experimenting is almost not taking place in the gardens, so that is something where improvements can be made. However, with the limited scope of manoeuvre for the women in the gardens this might be difficult to arrange by themselves, so an external party could help with this. Experimenting with improved management techniques can be enhanced through extension workers or the NARI (National Agricultural Research Center).

7.1.2 Land and water management practices

The land and water management practices which could be enhanced through learning are the use of traditional practices, improved management techniques that enhance soil fertility, water holding capacity and/or limit the water needs of crops. Drip irrigation can make water use more efficient and therefore more sustainable. Instead of looking at practices from outside of The Gambia and introducing them in the community gardens, it is good to look at what is already present locally and use those resources.

7.1.3 Role of the extension worker

The extension workers in the community gardens are mainly promoting the use of agro-chemicals and buying fertilizers. The use of more traditional practices, such as the use of groundnut shells, ashes, and the leaves of neem trees is not taken into account by the extension workers, even though these practices are used a lot in the gardens and they are sustainable practices. The people working in the gardens often have little money, so buying fertilizers or chemicals is not always possible or profitable for them. Extension workers could look more into ways of using these traditional practices that are easier for the women to have access to.

Currently the extension worker is mostly promoting the use of agro-chemicals, so a shift is needed from their side to include traditional methods in their scope of practices that are advised. Knowledge generation is a continuous process and researchers and extension workers should continuously keep in touch to know what is going on and capture new knowledge which is being generated (Kiptot et al., 2006). It is important to strengthen the innovative capabilities of extension workers (Spielman et al., 2008).

Ways to limit water use or the water need of crops is not being looked at or discussed by the extension workers, even though it is one of the main difficulties that the ones working in the gardens...
are facing. There are different ways in which an extension worker can do his or her job. He/she can transfer knowledge from what they learned to practitioners in the gardens, or they can facilitate farmer-to-farmer learning processes or learning through experimenting. Strengthening the innovative capacity of both extension workers and through them the innovative capacity of the women working in the gardens can contribute to the development of new practices (Spielman et al., 2008).

7.1.4 Role of other organisations
The role of other organisations in the gardens, such as the projects working on cultivating hot pepper for export, can help in increasing teacher-student learning in the gardens. However, these projects are in the gardens for a reason, and that is to make profit by exporting hot pepper crops, and not to increase sustainability in the gardens. The NARI is more objective since their aim is not to make profit, but collaboration is not yet happening, even though the gardens could benefit a lot from it.

7.2 Land and water management practices and sustainability
The practices which would be a possibility for sustainable land and water management in community gardens are the use of traditional practices, using improved management techniques which enhance soil fertility, water holding capacity and/or limit (evapo)transpiration.

7.2.1 Use of traditional practices
Traditional practices in the gardens are not being valued as much as they maybe should. The use of traditional practices; groundnut shells, ashes and the use of the leaves of neem trees as an agro-chemical, are sustainable in different ways. It limits the dependency on external inputs and increases the resilience of women working in the gardens on increasing prices of for example agro-chemicals. The use of groundnut shells as mulch is good for soil fertility and water holding capacity and it is locally available. What is needed for the women to use this practice is the knowledge about it and bridging social capital within the garden to be able to buy the groundnut shells collaboratively. The knowledge generation can come from extension workers or through farmer-to-farmer learning, since there are already people doing it. This would have to be facilitated by an extension worker or the president of the garden or someone else, to bring people together.

7.2.2 Improved management techniques
New practices could be introduced to enhance the soil fertility and water holding capacity. However, most of the women have been working their plots in the same way for a long time so it could be difficult to change things. This is also what another study on community gardens in The Gambia found, that the women sometimes find it difficult to accept new techniques (Baker and Edmonds, 2004). Therefore, it is good to look at sustainable practices which are already being practiced in community gardens and see how the use of these practices can be enhanced.

Enhance soil fertility
There are different ways in which the soil fertility can be enhanced. One of them is by using mulch. Groundnut shells are already being used as mulch material. Groundnut shells are widely available in The Gambia since groundnuts are grown all over the country, so it is a possibility for other community gardens as well. Other mulching materials such as dried grasses or crop residues which was mentioned by the NARI as beneficial for soil fertility can also be used. However, experiments should be done first to assess how well a certain type of mulch works under the specific conditions in the community garden before using new mulching material. Knowledge generation can be done through farmer-to-farmer learning, since there are already women using groundnut shells, or through teacher-student learning.
**Improved water holding capacity**

Improving the water holding capacity would be beneficial since limited water availability is an issue in community gardens in the dry season. Using mulch, as described above, would be one way to do that. Another way would be by not turning the soil, so that soil life and plant roots can create a soil with more micro and macro pores which can hold the water (Lal, 1974). However, since the women working in the gardens always turn the soil before planting new crops, probably to limit weed growth, this would be difficult to change within a short period of time and it is questionable whether to change this or not, because of the increasing labour demand for weeding and lack of access to and use of external inputs (Giller, 2009).

**Limit (evapo)transpiration**

Another thing that could be improved by using improved management technique is limiting the (evapo)transpiration. This can be done by covering the soil with mulch or by covering the soil with something else, such as the black cover plastic. The (evapo)transpiration can also be limited by changing the time of watering, not watering crops during the hottest part of the day, and/or by changing the way of watering, thus for instance by using drip irrigation. To change the time of watering would be difficult since it is dependent on when water is available and when the women have time to come to the garden to water. Changing the way of watering would be possible to change, but it requires an investment.

**Changes in water management**

For more sustainable water management in the gardens it would be good to change the time of watering too early in the morning or later in the afternoon when the sun is not that strong in order to limit water loss through (evapo)transpiration. This would be difficult to change however, because the women working in the gardens also have other things to do and sometimes the solar pump only pumps up water some time of the day.

The limited availability of water can be tackled by making more efficient use of the available water. That could be done by introducing drip irrigation or by investing in (better) water pumps and water tanks. However, investments are needed for this. Drip irrigation would decrease the water being used and the time necessary for watering. Rainwater harvesting is another promising option according to research done by Dile et al., (Dile et al., 2013) or sustainable agricultural intensification in water scarce areas according to this research.

Since little knowledge is present in the gardens on sustainable water management, it would be good to increase the knowledge of women about how much water crops need at which stage of the crop development. A watering scheme could be made for the whole garden, but in practice that would be difficult to start up since it requires a good organisation, which is often not present in the gardens.

**7.3 Circumstances**

There are some circumstances which relate to sustainable land and water management in the gardens that can be changed and some which are more difficult to change. The circumstances which have been described above; the lack of money of the women working in the garden to buy chemicals, diseases/pests in crops, limited availability of time, limited water availability and projects in the garden on growing hot pepper are sometimes possible to change and sometimes they are more difficult to change. What can be changed is the lack of money of the women and the limited availability of water.

Diseases/pests in crops is difficult to change, or new varieties which are more resistant have to be introduced which is possible but requires an outside actor to do that. The limited time availability
and the labour requirements of the women working in the gardens is also difficult to change. The projects on growing hot pepper for export purposes is arranged by export companies and at present there is little that the women have to say about that.

### 7.3.1 Investments

There is a lack of investments in watering systems, fences, of any kind of support in the gardens where the research has been conducted. All of the three gardens where the research has been conducted had a sponsor at some point, but at the time of research there were no sponsors anymore. Investments are mostly necessary to increase the access to water and to other basic resources needed in the gardens, such as a fence and a place to store crops. The problem with these things is who is supposed to invest in it? The government, with their slogan to ‘grow what you eat & eat what you grow’ seems an obvious answer, but that will be difficult as The Gambia is among the poorest countries in the world; although the president belongs to some of the richest. But being critical about the way the president is governing the country is a no-go area for Gambians (Allison, 2015). And if one-time investments are being done in community gardens, then the maintenance costs can become a problem. Thus investments are certainly necessary, but preferable on a long-term base.

### 7.3.2 Time and labour

Other constraints that play an important role in sustainable land and water management are time and labour. Time is needed for planting, weeding, preparing beds, watering which is almost all being done by hand labour. The women working in these gardens also have their household tasks and sometimes they live far away from the garden, so that also requires their time. The labour can be hard in the strong African sun so that should also be taken into account when looking at improved sustainable land and water management practices.

### 7.4 Social capital

Social capital, the bonding, bridging and linking social capital are important to enhance knowledge generation and bonding and bridging social capital are important for collective action on sustainable land and water management practices. Bridging social capital in community gardens can increase collaborative action within community gardens and bridging social capital, thus the links with other organisations, can help to improve their access to resources.

#### 7.4.1 Bonding social capital

The bonding social capital, thus the close links between people through being family members or close friends increases the transgenerational learning and farmer-to-farmer learning, but the bonding social capital would be very difficult to change by efforts from outside the women themselves.

#### 7.4.2 Bridging social capital

Strong links between the women working in the gardens, thus their bridging social capital, makes it easier to collaborate, and collaboration is important in these gardens. It can also increase the farmer-to-farmer learning and selling the crops on local markets is also done in collaboration since the produce per person is too small to take to local markets. A way to increase the bridging social capital is by either having leader in the garden who connects people or by having someone from outside the garden (e.g. an extension worker) who organises meetings among women. There are also no connections yet between different community gardens, this could also be helpful to have farmer-to-farmer learning not only within community gardens but also across different community gardens.
7.4.3 Linking social capital

The linking social capital is important in the gardens for having access to teacher-student learning and having access to funds to pay for the water system and other necessities.

What would be beneficial for sustainable land and water management in the gardens is more involvement of other organisations, for instance NARI, with community gardens. Currently the NARI has no collaboration with these community gardens, so there is a potential which is currently not being used. They can facilitate in both finding new sustainable land and water management practices by doing research and by experimenting and they can facilitate in the adoption of these practices through teacher-student learning.

Working together with other organisations/companies could help with marketing the produce. However, the produce per person is often way too small to market, so it is essential for the women to work together on this. The projects in the gardens promoting the cultivation of hot pepper could be a good opportunity for the women to learn about it and to engage in the export business, but the women working in the gardens should take care that they get something in return for their work. An export company could however enhance the sustainable land and water management practices through investments in the water systems and bring in other land management practices. But since the main objective of an export company is to produce hot pepper crops for export, they will probably not be that concerned with sustainability if there is no direct benefit from it.
8. Limitations of the research

In this chapter the limitations of this research that influence the results will be discussed; limitations on the research questions, the data collection and the analysis.

8.1 Research questions

This research has been done to find out the possibilities and constraints for sustainable land and water management practices on community gardens in The Gambia. When you do research, there is always a choice you make, either consciously or unconsciously in what you take into account and what you focus on and what you don’t include in your research. In this case, the focus was on the actual practices being done, the sustainability and the learning process; where and how did/do they learn?

The focus was on sustainability from the perspective of the ones working in the gardens as well as the physical aspects of sustainability. The latter has however only been assessed by using literature, instead of doing actual field measurements on for instance organic matter. It would have been good to include that as well, but due to a focus on knowledge generation, practices and sustainability and how they link to each other, this has not been done. The knowledge generation/learning aspect has been chosen because it seen as an important reasons of why things are done in a certain way and the forefront of change.

The research question on where the people working in the gardens learned has been assessed only by their view of where they got their knowledge from instead of getting to know exactly how those processes work.

8.2 Data collection

The issue with having pre-defined concepts is that you already limit your view on those concepts. In a research done by Denzau and North (Denzau and North, 1994) they say that individuals will have different theories (models, ideologies) to interpret their environment. Of course it is necessary in research to make use of concepts because otherwise you will probably get lost in doing research, since there are too many things to be looked at. But by having these concepts and wanting to see links between them, you will find them even when there might be other important factors which are not take into account since it is not part of the research. In this research this issue was dealt with by talking to the interviewees not only about the things related directly to the interviews, but also be there when the women were having lunch together and by showing interest not only in their practices on the gardens, but in their families and their lives. By going to the community gardens regularly the women also got used to me being there instead of looking at me with some suspicion of what I was doing there.

This research has been conducted in February-May which is in the dry season of The Gambia. Some of the results, like the crops being grown, are time-specific. The community gardens during the rainy season are completely different from the ones described now. Some of the findings, such as the limited availability of water, do not play a role in the rainy seasons. Some practices might be advisable to do during the dry season, but not in the rainy season. The conclusions are therefore also only based on the state of the community gardens in the dry season.

Most of the data used in this research has been collected through interviews with a translator. With interviews, there is always the issue of people not telling the (whole) truth, misunderstandings, different meanings the researcher and the interviewees give to certain concepts, people telling you what they think you want to hear or simply not knowing something but still giving an answer. For instance, the farmer-to-farmer learning was not often mentioned as their main source of knowledge.
This could be due to the fact that it really did not play an important role, or to the fact that they did not recognise it as a way of learning. Taking into account their culture, which is much more focussed on the collective or community than the Western culture, the whole concept of knowledge as something which is ‘owned’ by one person (which is the way people see it in Western countries) is probably also different. They probably see knowledge not as something one person ‘has’, but rather a collective body of knowledge which is shaped by their ancestors, the climate, stories and experiences. This was something I observed in the Marakissa community garden, where some people had a disease in the onions that made the leaves become dry and white-spotted. Their story behind this was that it was because of the air quality, there was ‘bad air’ which made the leaves of the onion crops like that. All the women who were talking about this problem they had with the onions mentioned the ‘bad air’ as a reason.

8.3 Analysis
The women in the Banjulinding community garden were mostly working in groups, so during the data analysis these interviews counted double compared to the other two gardens, because during the interviews in Banjulinding there were usually 2-3 people interviewed together and with the groups they also cultivate two plots.

When talking about sustainability the question of ‘who’s sustainability are you talking about?’ keeps on coming up. In this research, the choice was made to both look at the ‘local’ sustainability and sustainability from a practical point of view; focussing on less use of external inputs, improved sustainable land and water management practices and efficiency. But this can also be discussed, since it is also possible to become more sustainable in land management practices by using more external inputs, if for instance mulching material is not coming from local markets but from ‘outside’ of the local markets for a good price. But since in this research the resilience from outside factors have been taken into account for the women working in the gardens and because of literature it has been done in this way.

It is difficult to come to a conclusion about the sustainability of their practices based on literature, since some literature is contradicting and the literature is from other places, not from the specific community gardens in The Gambia. It something is sustainable, if a practice such as applying leaves of neem trees as a pesticide or using wood ashes works, depends on the climatic conditions, the type of crop, the diseases/ pests that are present and how exactly it is being applied. It is therefore difficult to come to a conclusion, since on-site, in-depth research would be needed to get this knowledge scientifically.

During and after conducting the research it became clear that social capital plays a bigger role in processes than I previously thought. It would have been good to include more about that in the research by asking questions about it and actually assess the social capital of the women and the difference between the gardens. But that was not possible due to time limitations.

It would have been good as well to include a small cost-benefit analysis on input and output prices to get more insight in how price balances influence people their decisions, since it was often mentioned by interviewees that they didn’t do something because it was too expensive for them. Some data has been collected about this, but not enough to make conclusions from it. Although even if more data had been collected about prices etc. it would have still been difficult to come to conclusions, because then also the women their own consumption of their produce would have to be taken into account as well as other incomes in their families.
The three community gardens where the research has been conducted were used to be able to say something more general about community gardens in The Gambia. Some of the circumstances will be the same in other gardens but some will also be different which might change the possibilities and constraints in different gardens. For instance the possibility of working with the NARI might work really well in some cases but in other cases it might not be practical at all, because of the location or other things. Furthermore, the research has been conducted in the dry season (February-May) which gives a totally different picture compared to if you would to research in the gardens during the rainy season.
9. Conclusion
The main research question; ‘What are the possibilities and constraints for sustainable land and water management in terms of learning and practices on community gardens in The Gambia?’ will be answered below according to the findings on the three community gardens in The Gambia.

Learning
Learning can be a catalyst for change in community gardens. Farmer-to-farmer learning and experimenting can be enhanced through extension workers facilitating meetings among women in the community gardens. Extension workers can improve their work in community gardens by adjusting their advice to the situation in which the women working in the community garden find themselves by including traditional practices in the teacher-student learning. Learning through experimenting is currently almost not being used but it is a good opportunity to create more sustainable land and water management practices in the gardens.

Sustainable land management practices
Instead of introducing new practices, it would be good to make more use of traditional practices such as using groundnut shells as mulch, using ashes to keep insects away and improve the soil fertility and using a mixture with neem tree leaves as a bio-chemical. Knowledge on sustainable land management practices is present; some women use mulch already, but can be enhanced. That knowledge mostly comes from experience and trans-generational learning, so extension workers can provide more knowledge through teacher-student learning. Other mulching material, such as dried grasses or crop residues may also be suitable so it is recommendable to experiment with that to see if it would work in the community garden. The (evapo)transpiration can be limited by covering the soil with mulch or with something else, for instance black cover plastic.

Sustainable water management practices
The (evapo)transpiration can also be limited by changing the time of watering to early morning or late afternoon/evening or by introducing drip irrigation, which increases efficiency of water use. Knowledge about sustainable water management practices is not within the teacher-student learning yet, so improvements can be made there to increase the knowledge of the women in the community gardens on how much water certain crops need at which point in the growth stadium and on how to make more efficient use of the available water. This can be done through teacher-student learning from extension workers.

Social capital
Bonding, bridging and linking social capital within community gardens are important for the learning process and the use of sustainable practices. Bridging social capital enhances farmer-to-farmer learning and collective action in the gardens. Bridging social capital can be enhanced through an extension worker who facilitates meetings among women in the gardens. Linking social capital enhances teacher-student learning and access to resources and investment funds. Investments are necessary to improve current water systems to adjust them to the water needs of the gardens and to maintain them. A place to store crops, a good fence around the garden and a place where crops can be sold close to the community gardens are needed and also requires an investment which can come from the Gambian government, NGO’s or other sponsors. Investments to facilitate experimenting with different crops and/or practices would also be good since the women have little possibilities to do it themselves. Linking social capital can be enhanced by creating links with the research institute NARI, the agricultural department and creating links to local and/or export markets.
10. Recommendations
To create more sustainable community gardens in terms of land and water management practices, it is recommendable to do research on the effect of different land and water management practices on the community gardens. This could for instance be done on different types of mulch or applying different amounts of water and assess the results. Since water availability seems to be the main concern in the community gardens, it would be good to do an in-depth research of how much water is available, how much is needed and if changes can be made to improve the water availability. It would be good to do research on possibilities for rainwater harvesting in the community gardens.

More research should be done on what the best way of learning is for women working in the gardens. Who do they see as knowledge experts; the extension workers? Their parents? Other women working in the gardens? How do they value their own capabilities of experimenting and learning through experience? What would be the best way to use the knowledge that the women have on land and water management practices to include that in the knowledge of extension workers and also include it in what extension workers advice the women.

Another topic where more research should be done is the role of social capital in community gardens and how to increase social capital. There is little research done on that topic although in this research it was found to be an important aspect related to if practices were being done or not.
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Annex A

Interview questions for people working on community gardens

Background information community garden:
For how long has this community garden existed?
Did/ do they have sponsors? Who are the sponsors?
What is the size of the community garden?
How many people work in the community garden?
What is the water source? How much water is available per day? How is the water use regulated?
What are the main difficulties in the community garden?

Background information interviewees:
For how long does he/she have a plot in the community garden?
How did he/she get a plot?
What is the size of the plot he/she has?
What is his/her age?
What is the education level of him/her?
With how many people does he/she live together in the household?
What is his/her main source of income? What is the main source of income for the household he/she lives in?

Knowledge, practices and perception of sustainability:
How does he/she explain soil fertility?
Analysis: Does he/ she talk about the long-term use of the soil, that it is necessary to keep the soil fertile in order to be able to grow crops in the coming years?

If and how does he/she try to enhance soil fertility?
Analysis: Does he/ she put a lot of effort in enhancing the soil fertility or is it not an issue for him/ her?
How does he/she tries to enhance soil fertility?

What are the land management practices he/she is doing? Why these practices? (Relate this to my own observations)
Analysis: What kind of practices? Why these practices? Does he/ she talk about the long-term use of the land, limiting evapotranspiration, keeping soil moisture? What does the plot look like? Do the plants look healthy or not? Is the soil covered or not?

Does he/she know the idea of applying mulch? Does he/she apply mulch? Why?
Analysis: Does he/ she talk about soil moisture or about reducing evaporation of water? Does he/she talk about keeping the soil fertile?

Does he/she know about crop rotation or intercropping? Does he/she apply crop rotation or intercropping? Why or why not? If yes; with which crops? Why these crops?
Analysis: Does he/ she talk about nutrients in the soil/ soil fertility/ not depleting the soil? Does he/she use nitrogen-fixing crops?
Does he/she use fertilizer? Why or why not?
Analysis: Does he/she talk about soil fertility or about what the crops need?

Does he/she use pesticides? Why or why not?
Analysis: Why does he/she use pesticides or why not?

Where does he/she get the seeds from? Are these improved seeds or not?
Analysis: Does he/she use improved seeds? Does he/she know about improved seeds or (local) seeds that are adapted to the local environment?

How does he/she know how much water to apply? How much water does he/she apply? How often does he/she water the crops? When does he/she water the crops?
Analysis: Does he/she use water consciously? Does he/she know how much water the crops need or does he/she just waters them without knowing if it is too much or too little? Does he/she water the crops in the morning or evening to limit the loss of water from (evapo)transpiration?

Which crops are being grown? Why does he/she grow these crops?
Analysis: Does he/she talk about that this crop is the best suitable for this climate, it can handle water stress, it can grow on these type of soils or about profit as a main reason?

What is the use of these crops? If they are being sold, where is the money used for?
Analysis: Is the community garden important for them? Are they interested in sustainable use of the community garden?

How does he/she explain sustainability?
Analysis: does he/she know the concept? What words does he/she use to explain sustainability; being able to grow crops next year/ in ten years/ for their kids to be able to use the land? About land degradation/ depletion of the soil? About keeping soil fertility? About profit they make from crops? About (future) markets for their crops? How does this relate to their practices?

Does sustainable use of the land and water play a role in the kind of practices they do? Is it important, does it play a role or none at all?
Analysis: is it important for them, does it play a role or none at all? How does this relate to their practices?

Learning

In the past
Where his/her parents involved in farming?
Analysis: trans-generational learning.

Did he/she learn something about agriculture from them? If yes; a lot, some or a little bit.
Analysis: trans-generational learning and learning through experience.

Did he/she learn about agriculture in school? What kind of things did he/she learn? For how many years did he/she get agricultural education in school?
Analysis: teacher-student learning.

Did he/she learn from other farmers/ other people working in the community garden? Often, sometimes, occasionally or never?
Did he/she follow any training program in agriculture on the community garden? Often, sometimes, occasionally or never?
*Analysis: teacher-student learning.*

Did he/she follow any training program in agriculture outside of the community garden? If yes; where and what kind of institution(s)? What kind of training program? For how long?
*Analysis: teacher-student learning.*

Did he/she experiment with different crops or different land or water management practices? Often, sometimes, occasionally or never?
*Analysis: learning through experimenting*

**Nowadays**
Does he/she learn from other farmers/ other people working in the community garden? Often, sometimes, occasionally or never?
*Analysis: farmer-to-farmer learning.*

Does he/she follow any trainings on the community garden? If yes; what kind of training? How often?
*Analysis: teacher-student learning.*

Does he/she follow any trainings outside of the community garden? If yes; where and what kind of institution(s)? How often?
*Analysis: teacher-student learning.*

For how long has he/she been working in the community garden?
*Analysis: learning through experience.*

Does he/she experiment with land or water management practices or crop choice to see if something is working better? Often, sometimes, occasionally or never?
*Analysis: learning through experimenting.*