

**Livelihoods and production in smallholder irrigation schemes:
The case of New Forest Irrigation Scheme in Mpumalanga Province**

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Institute for Poverty, Land and Agrarian Studies (PLAAS)

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KEYWORDS

Smallholder farmers

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New Forest Irrigation

Farming styles

Livelihood trajectories

Gross margins

Mpumalanga



ABSTRACT

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MPhil in Land and Agrarian Studies

Institute for Poverty, Land and Agrarian Studies (PLAAS)

This study explored the production and livelihoods of smallholder farmers in irrigation schemes in South Africa. The particular focus has been on the farming styles of smallholder farmers, the impact of irrigation scheme production on their income and livelihoods, and the issue of smallholder social differentiation. The New Forest irrigation scheme located in Bushbuckridge Local Municipality was used as a case study. The research methodology utilized a combination of extensive and intensive research designs. The farming style approach was compared with the livelihood strategies approach to determine the relationship between the farmers' approach to farming and their livelihood development trajectory. The underlying assumption is that small-scale irrigation has the potential to make a positive contribution to the livelihoods of farmers. New Forest irrigation farmers face a number of challenges at the irrigation scheme such as neglect by government, inadequate irrigation water, and access to affordable crops inputs. The farmers were not organised to be able to purchase inputs, engage in co-operative marketing, and manage the irrigation scheme. The notion of investing in smallholder irrigation schemes in order to convert smallholders into commercial farmers is unrealistic. Those that were classified as 'food farmers', benefit from irrigation development and participation through meeting their household consumption needs. Those classified as 'employers', obtained negative gross margins per plot and hired most farm labour. Diversification by employers into other less risky livelihood activities on-farm and off-farm is an option. The 'profit makers', make high returns from crop production, and obtained the highest gross margins per plot. This thesis argues that support to farmers in smallholder irrigation schemes should be provided in the context of their farming objectives, and livelihood aspirations which are not only varied but evolve across time and individual circumstances.

November 2014

DECLARATION

I declare that *Livelihoods and production in smallholder irrigation schemes: The case of New Forest Irrigation Scheme in Mpumalanga Province* is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Bulisani Lloyd Ncube



November 2014

Signed:.....

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LIST OF ACRONYMS

AIDS	Acquired immune-deficiency syndrome
ANOVA	Analysis of Variance
BEE	Black Economic Empowerment
BLM	Bushbuckridge Local Municipality
CAN	Calcium Ammonium Nitrate
COMBUD	Computerised Enterprise Budgets
DAFF	Department of Agriculture, Forestry and Fisheries
DRDLR	Department of Rural Development and Land Reform
DTI	Department of Trade and Industry
FAO	Food and Agriculture Organisation
GM	Gross Margins
HIV	Human Immuno-deficiency Virus
ICA	International Cooperative Agreement
IDP	Integrated Development Plans
IOFs	Investment-oriented Firms
LED	Local Economic Development
NDP	National Development Plan
PTO	Permission to Occupy
RESIS	Revitalisation of Smallholder Irrigation Schemes
RDP	Reconstruction and Development Programme
SPSS	Statistical Package for Social Sciences

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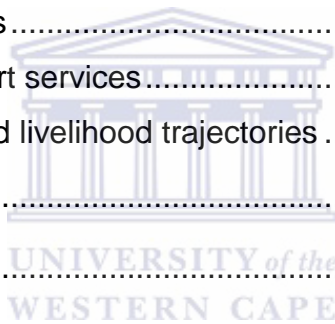
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CHAPTER ONE: INTRODUCTION AND BACKGROUND

This study explores the contribution of small-scale irrigation farming to the livelihoods of farmers at New Forest Irrigation Scheme. It focuses on the theoretical aspects of smallholder farming and irrigation schemes in particular. The demographic profile of the irrigators, irrigation crop production, and marketing and agricultural support mechanisms are discussed in detail to show the contribution of irrigation farming to the livelihoods of smallholder farmers.

This chapter introduces the research study on smallholder irrigation schemes in South Africa. It firstly provides the context in which the New Forest irrigation scheme operates in Bushbuckridge Local Municipality and the history of the irrigation scheme. This is followed by the rationale of the study and the research study objectives, key research theories to be utilized and the research methodology that was used.

1.1. Bushbuckridge local municipality

Bushbuckridge Local Municipality is one of the five local municipalities of Ehlanzeni district municipality of Mpumalanga Province in South Africa (refer to maps of Mpumalanga, Ehlanzeni and Bushbuckridge in figures 1-3 below). It is located in the north-eastern part of the province bounded by the Kruger National Park in the east, Mbombela local municipality in the south, and Thaba Chweu local municipality in the southwest (Bushbuckridge IDP 2013/2014: 20). By virtue of its location, it is labelled as the gateway to the tourist attraction locations in Mpumalanga and Limpopo Provinces. Agriculture and tourism are the key economic activities in the municipality. The major challenges according to the Integrated Development Plan (2013/2014:20) include high poverty rates, unemployment, backlog of service delivery, skills shortage, high illiteracy and high HIV and AIDS prevalence.



Figure 1: Map of Mpumalanga Province in South Africa¹

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¹ Source: Down loaded from:

http://www.google.co.za/imgres?imgurl=http%3A%2F%2Fupload.wikimedia.org%2Fwikipedia%2Fcommons%2Fthumb%2Fc%2Fc4%2FMpumalanga_in_South_Africa. On 28 November 2014.



Figure 2: Map of Ehlanzeni District Municipality in Mpumalanga Province²

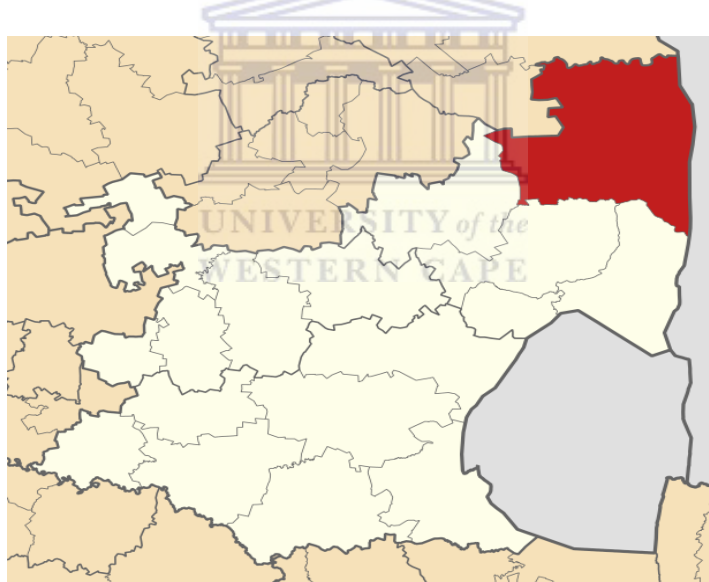


Figure 3: Map of Bushbuckridge Local Municipality in Ehlanzeni District Municipality³

² Source: Down loaded from:

[http://www.google.co.za/imgres?imgurl=http%3A%2F%2Fupload.wikimedia.org%2Fwikipedia%2Fcommons%2Fthumb%2F5%2F5d%2FMap_of_South_Africa_with_Ehlanzeni_highlighted_\(2011\).](http://www.google.co.za/imgres?imgurl=http%3A%2F%2Fupload.wikimedia.org%2Fwikipedia%2Fcommons%2Fthumb%2F5%2F5d%2FMap_of_South_Africa_with_Ehlanzeni_highlighted_(2011).)

On 28 November 2014.

The agricultural sector in Bushbuckridge local municipality is characterised by six types of primary production as elaborated in the municipality's Local Economic Development (LED) Strategy 2010 to 2014. These include the following:

- a) *Uncoordinated broiler producers selling through abattoirs;*
- b) *Smallholder vegetable producers situated in the four major irrigation schemes of Dinglydale, New Forest, Hoxane and Sabi River;*
- c) *Small-scale fruit growers in the former development corporations' irrigated orchards;*
- d) *Small-scale macadamia growers established through the Department of Agriculture, Forestry and Fisheries (DAFF) programme;*
- e) *Dry-land farmers growing maize and sugar beans for mainly subsistence purposes; and*
- f) *Cattle farming through small scattered herd rearing.*

The four major smallholder irrigation schemes in Bushbuckridge fall under the Department of Agriculture, Forestry and Fisheries (DAFF) and the Department of Rural Development and Land Reform (DRDLR) of Mpumalanga Province. Dingley Dale and New Forest have about 1,668 ha and 1,065 farmers (BLM 2010:53). Sabi River and Hoxana have 109 farmers and a total of about 600 ha (BLM 2010: 45).

1.2. New Forest Irrigation Scheme

History of the irrigation scheme

The New Forest Irrigation Scheme is located in the Bushbuckridge Local Municipality of Mpumalanga Province in South Africa. The irrigation scheme has a size of approximately

³ Source: Downloaded from:

[http://www.google.co.za/imgres?imgurl=http%3A%2F%2Fupload.wikimedia.org%2Fwikipedia%2Fcommons%2Fthumb%2F3%2F3e%2FMap_of_Mpumalanga_with_Bushbuckridge_highlighted_\(2011\).](http://www.google.co.za/imgres?imgurl=http%3A%2F%2Fupload.wikimedia.org%2Fwikipedia%2Fcommons%2Fthumb%2F3%2F3e%2FMap_of_Mpumalanga_with_Bushbuckridge_highlighted_(2011).)

On 28 November 2014.

622 ha and 531 farmers (plot-holders) (Agterkamp 2009:69). Estimates from the extension officers in the Department of Agriculture are that the scheme is about 1000ha. This is very different from the estimates from the Bushbuckridge LED Strategy document and also from the study by Agterkamp (2009), and Bembridge (2000:26). Currently not all of the scheme is being utilized (with estimates that approximately 160 ha are being utilized) and not all farmers are actively farming. Appendix 4 shows a map of the New Forest and Dinglydale irrigation schemes. The irrigation scheme is gravity fed from the perennial Orinocco dam through the Mutlumuvhi River and has 9 reservoir/storage dams, of which 8 are currently operational. The defunct reservoir has a broken down valve that makes it difficult to control water coming in and going out. Due to lack of maintenance the reservoirs are highly silted while some carry a lot of litter (paper and shrubs) and do not hold a lot of water.

The scheme dates back to the 1960s when it was taken from a private company and transferred by the government of the day to the local people. The New Forest irrigation scheme was initially an initiative of the white minority government that had contracted a private company to grow tobacco. After the contract ended the government decided to subdivide it and designed it for smallholder irrigation farming. The government thus resettled black household families in the four wards of New Forest village (New Forest, Tsuvulani, Edinburgh, and Demulani) around New Forest irrigation scheme and allocated corresponding 1 ha plots to each household for irrigation farming. This closely followed the Tomlinson recommendation that irrigation holding of between 1.3 ha to 1.7 ha were adequate for an African household's livelihood needs (Perret 2001:3).

All the households that were resettled were given the permission to occupy (PTO) certificates from the tribal authority. The tribal authority at New Forest is called the 'Amashanga'. The farmers saw this system as a secure tenure arrangement as they have usufructuary rights to use the land, pass it on to their children and also rent or lend to others. What is not clear, though, is whether such a tenure system will encourage farmers to make high value and long-term investments.

Three types of land tenure arrangements exist at New Forest irrigation. The first group is the '*PTO holders*', which acquired land either from the government/chief or through inheritance from parents and/or relatives. These possess the permission-to- occupy certificates. The second group is the '*self-allocated plot holders*' category in which land adjacent to the existing plots was cleared and converted into an irrigation plot. Falling under this group include existing *PTO holders* that extended their plots to get more irrigable land, those that did not have access to land at all, and *tenants* that identified adjacent and un-demarcated irrigation land and converted this into an irrigation plot. The third group, '*tenants*', consists of farmers that do not 'own' land at the scheme but either borrow for free or rent the land for an annual fee paid to the PTO-holder.

The purpose of the establishment of this scheme was to ensure that the households resettled in the villages could make a living (food and some money for survival) through farming at the irrigation scheme. The water source for irrigation is usually not adequate for the plot-holders especially during the dry season. The plot-holders own and/or have access to different plot sizes (areas between 1 ha and 6 ha) where they plant mostly maize, groundnuts, green beans, tomatoes and cabbages for subsistence production and for sale to local individuals, vegetable traders, and 'bakkie'⁴ traders.

The management structure of New Forest irrigation scheme consists of a cooperative led by the farmers' committee. The farmers' committee is made up of farmers' representatives and has a chairperson, secretary, treasurer and respective deputies and committee members. The role of the cooperative is to provide services and technical assistance to the farmers, such as tractor services, advice and extension.

Irrigation water supply

The main concrete canal channels water from the reservoirs to the transverse canals that feed in-field short furrow canals through various diversions and outlet valves. The concrete canal is 53 years old and has many cracks that result in water leakages

⁴ An Afrikaans word meaning a small vehicle with an open part at the back in which goods can be transported.

throughout its body. The main fence that demarcates the fields has not been maintained as some sections are broken allowing livestock to access the fields.

The advantage of an irrigation scheme over dryland farming is that it provides reliable water that can be utilised throughout the year thus providing all year round possibility of farming. The risks associated with dry-land farming, which is based on only 600 mm per annum for Bushbuckridge, are thus mitigated. There is no rainfall from April to October, while the rainfall is highly variable, and rain often occurs in heavy downpours leading to erosion and damage to crops (DPLG 2007:74).

The water is fed into eight reservoirs from the Mutlumuvi River by gravity using the large concrete canals. The water also flows by gravity to the irrigation plots through valves and sub-canals. Most of these sub-canals have cracks experiencing significant water losses while in some locations they are entirely broken down. Within the farmers' fields they utilize sand sacks to control the amount of water flowing into their plots. The short-furrows within the individual irrigation plots provide a channel for the water to reach the crops. This results in erosion of soil.

1.3.Rationale and significance of the study

Smallholder irrigation in South Africa has been defined by a long history that includes issues of social policies of racial segregation and benefiting mainly white commercial farmers (van Averbek, *et al* 2011:797) to the issues of irrigation management transfer and revitalization which sought to benefit black small-scale farmers in rural areas (Ibid 2011:805).

The Government of South Africa has engaged in land reform processes to redress past imbalances and meet the objectives of poverty alleviation and economic growth. Active and productive engagement in the agricultural sector is seen to contribute to improving livelihoods of rural poor households. This is addressed through an agricultural

development focus in dryland farming, livestock production and investment in irrigation schemes.

Irrigation schemes are seen as a channel that mitigates the risks of dryland farming, as it provides the possibility of farming throughout the year. The National Development Plan (NPC 2011:197) of South Africa states that without major policy interventions, the agricultural sector could continue to shed employment, mostly due to land consolidation and technical change. It therefore proposes that agriculture could establish over a million direct and indirect jobs if land can be planted to labour-absorbing crops. One of the key proposals tabled in the National Development Plan is substantial investment in irrigation infrastructure, leading to an increase of 33% of land under irrigation over a period of 10 years. In this context, smallholder irrigation schemes are seen to be one avenue to achieve goals of poverty alleviation and economic growth.

Although the government of South Africa has invested quite significantly in smallholder irrigation to improve the livelihoods and incomes of smallholder farmers and reduce poverty, it is failing to meet expectations. It is beset by a whole range of common challenges that include technical, management, training, unsupportive agricultural policy, and financing problems (van Averbeke, *et al*, 2011:799; van Averbeke 2012:421; Fanadzo 2012:1957). Gomo (2012:ii) asserts that the performance of smallholder irrigation schemes is below the expectations of stakeholders, and that it is a multi-dimensional problem that needs to be assessed from multiple viewpoints.

Smallholders engaged in small-scale irrigation (i.e. on less than 5 ha) are quite diverse and follow different livelihood strategies that are often complex. Cousins (2011: 3) observes that the problem of assuming that smallholders are a homogeneous group is that this tends to obscure inequalities and class-based differences within the large population of households engaged in agricultural production on a relatively small scale. This diversity and complexity needs to be understood by policy makers, as well as by implementing agencies, as blanket approaches will be inadequate.

If small-scale irrigation is to yield significant gains in terms of the employment and incomes of the poor, it is critical to identify what type of smallholder farmers are engaged in irrigation farming. Key constraints faced by small-scale farmers need to be understood and inform approaches that will work to their advantage on a sustainable basis. It is pivotal to know which types of smallholder farmers are engaged in irrigation farming and what problems result in low yields, low incomes, and what are the dis-incentives that cause dis-investment in the smallholder sector. The overarching issue is to determine how irrigation schemes impact on the livelihoods of smallholder farmers. How the South African government conceptualizes the contribution of smallholder irrigation schemes to economic development, employment and income generation will determine the corresponding policy framework and approaches adopted for irrigation development.

Many studies have conducted research on irrigation schemes in KwaZulu-Natal, Eastern Cape and Limpopo Provinces (Cousins 2013; Denison and Manona 2007b; Fanadzo *et al* 2010b; Machethe *et al* 2004; van Averbek *et al* 2011). Though there are quite a number of smallholder irrigation schemes in Mpumalanga, these have not been researched on extensively compared other provinces. This research will provide a detailed study on livelihoods of smallholder farmers in New Forest irrigation scheme in Mpumalanga Province. As part of the research on smallholder farmers in South Africa, and smallholder irrigation schemes in particular, this research is a component of a research programme supervised by Professor Ben Cousins, the DST/NRF Research Chair in Poverty, Land and Agrarian Studies at the University of the Western Cape.

1.4.Key concepts and theories

The major theories and concepts used in this study derive from ideas about ‘farming styles’ and ‘livelihoods strategies and trajectories’. These are relevant for exploring the realities of smallholder farmers engaged in irrigation scheme production, given the diversity of the strategies and activities that they tend to pursue in obtaining their livelihoods.

Van Averbeke and Mohamed (2006a: 138) define farming styles as a portrayal of a particular way of practicing agriculture, and thus of combining and ordering the various activities and elements involved in agricultural production. The importance of classifying farming styles is the recognition that farmers are not homogeneous, be it in relation to their resource endowments, approaches to farming, management of risks or adoption of technologies (Van de Ploeg 2010: 1; Vanclay *et al* 1998: 85; Schwarz *et al* 2004: 33). Van Averbeke and Mohamed (2006a: 147) used a farming styles approach to classify farmers into ‘*employers*’ who were employing full time labour in their plots, ‘*food farmers*’ devoted mostly to household food production, and ‘*profit makers*’ who farm primarily for selling and generating significant income. This typology was used in this study to classify New Forest irrigation farmers, based on data on the ways that they practice agriculture, the risks that they take, and the variable outcomes of their farming activities.

Dorward *et al* (2009: 3) argue that livelihood strategies combine households’ assets in activities to produce outputs that are used to both meet consumption requirements and to invest assets and activities for the future. Livelihood theory is relevant for smallholder farmers engaged in irrigation schemes as they combine their assets (household and agricultural) in activities to produce crops and income for consumption and future investments.

Dorward *et al* (2009: 4) proposed three types of livelihood strategies that households pursue, i.e. ‘hanging-in’, ‘stepping-up’ and ‘stepping-down’. ‘Hanging-in’ households are those where assets are held and activities are engaged in order to maintain livelihood levels in adverse socio-economic circumstances. ‘Stepping-up’ households engage in activities and investment in assets in order to expand their activities, so that production and income increases and thus improve their livelihoods. ‘Stepping-out’ households engage in existing activities to accumulate assets which in time provide them opportunities for diversifying their activities into other livelihood strategies that become relevant.

The farming styles approach is compared with the livelihood strategies approach to determine the relationship between farmers' approach to farming and their livelihood development trajectory. Van Averbek and Mohamed (2006a:152) argue that particular styles are strategically and structurally congruent with particular types of livelihoods.

1.5. Research Objectives

The overall question that the research study attempted to answer is: 'What is the contribution of small-scale irrigation farming to the livelihoods of farmers at New Forest Irrigation Scheme?' The underlying proposition is that small-scale irrigation makes a positive contribution to the livelihoods of farmers. The key sub-questions that flowed from this are:

- What is the socio-economic profile and status of smallholder farmers engaged in farming at New Forest Irrigation Scheme?
- What are the agricultural production levels of smallholder farmers at New Forest Irrigation Scheme, and how can they be improved?
- What is the contribution of income from irrigation farming to the livelihoods of the farmers, and is there potential for this contribution to be enhanced?
- What is the character of the land tenure system at New Forest Irrigation Scheme and how does this influence agricultural productivity?
- What organizational arrangements are in place at the irrigation scheme in relation to managing common resources such as irrigation water, access to inputs and marketing of crops?
- What agricultural support systems and mechanisms are in place to enable smallholder farmers to improve their productivity, how effective are these, and how can they be improved?
- What are the wider policy implications of the research findings?

1.6. Research design and methodology

This is an observational in-depth case study of one smallholder irrigation scheme. The research utilized secondary and primary data collection methodologies. The study began by conducting a detailed literature review of various studies on smallholder irrigation in South Africa. The relevant literature included studies and reviews of the history of land reform, livelihoods in rural South Africa, and opportunities and constraints that smallholder farmers have faced in their endeavours to become productive and engage in accumulation. The focus of the literature review was on land tenure arrangements, small-scale farming, irrigation farming, the impact of social grants and other off-farm livelihoods on smallholder farming, and the current support systems that are provided to smallholder farmers such as extension, training, and financial resource support.

Theories related to smallholder farmers were also reviewed in an effort to understand the underlying causes of the behaviour of smallholder farmers in pursuing their livelihoods in communal areas. These include debates on small-scale versus large-scale farming, farming styles, capital accumulation, and typologies of differentiating smallholder farmers.

Primary data were collected over a month with the aid of a local translator, during the month of August 2013. This process utilized a combination of extensive and intensive research approaches. Swanborn (2010:1) defines an extensive research approach as the collection of information about the relevant properties of a large number of instances of a phenomenon. Each survey respondent provides information based on a standardized set of questions that are aggregated over all the respondents to create information about relationships between the variables under study, to enable understanding and explanation of the phenomenon (Swanborn 2010:2). Putting all this information together, and calculating and interpreting correlations between properties of these examples, enables one to draw conclusions (*ibid*).

An intensive research approach, on the other hand, focuses on a specific instance of the phenomena to be studied, or a handful of instances, in order to study the phenomena in great depth (Swanborn 2010: 2). Each instance is studied in detail in its own specific context. Data using this approach are collected using a variety of methods such as in-depth interviews, focus group discussions, life history interviews and observations.

The different types of interviews conducted during my study included a household survey that included crop data sheet administration, in-depth life history interviews, interviews with extension staff, and interviews with the New Forest irrigation committee representatives. This provided a wide range of information that could be triangulated across the different methods.

Sampling

The household was the unit of enumeration used in this study. A household was defined as people that belong to the homestead, that live together most of the time, and that eat from the same pot. This excludes domestic servants, and family members that reside away from the homestead. In order to make the household survey sample representative, households were identified through a random stratified sample. Stratified sampling guarantees that the sample adequately represents relevant strata within the population (Durrheim and Painter, 2006: 136). This ensures that the different strata across the sample frame are represented. The New Forest irrigation scheme is divided into sections called wards, which are separated geographically. It was thus essential to interview farmers across these strata, as it was likely that there were differences in terms of management and access to water resources, extension and access to hawkers and ‘bakkie’ traders coming to purchase the crops.

The sample was stratified across the four wards of New Forest Village, i.e. New Forest, Tsuvulani, Demulani and Edinburgh wards. Durrheim and Painter (2006: 137) argue that stratified sampling can be undertaken either through proportionate or disproportionate stratified sampling. The former selects the same proportion from each stratum as they

occur in the population, while the latter oversamples some strata compared to others (*ibid*). In my case I used disproportionate stratified sampling, as it could not be established how many active farmers are present across the 4 wards of the scheme.

Table 1: Proportion of New Forest irrigation farmers sampled for the household survey

Ward Name	Frequency	Percentage	Cumulative Percentage
New Forest	24	25.5	25.5
Edinburgh	18	19.1	44.7
Tsuvulani	36	38.3	83
Demulani	16	17	100
Totals	94	100	

As shown in Table 1 above, disproportionate sampling was undertaken across the four New Forest wards, with most households interviewed from Tsuvulani, and the least from Demulani. The extension staff at the scheme had advised that there are fewer active farmers at Demulani and Edinburgh wards compared to New Forest and Tsuvulani wards.

In order to facilitate easy administration of the survey tools and to establish rapport, the extension officer introduced me to the irrigation committee and the farmers that were present during the farmers’ meeting at the cooperative offices as a student from the University of the Western Cape.

Transect walk

A transect walk is a tool for describing and showing the location and distribution of resources, features, landscape, and main land uses along a given transect (Fauna and Flora 2013: 1). A transect walk is generally useful for seeing the ‘bigger picture’ and understanding the context before the actual interviews are administered. Fauna and Flora (2013: 1) further argue that it is useful for identifying and explaining the cause and effect relationship among topography, vegetation, cultivation and other production activities.

A rapid transect walk across the New Forest irrigation scheme was conducted to capture various physical and socio-economic aspects that have a bearing on the scheme

operation. This was conducted with the assistance of a local key informant. This provided an opportunity to inspect the main irrigation reservoirs, the main irrigation canal and sub-canal. The transect walk also provided me with an idea of the level of activity at the irrigation scheme through inspection of the active plots and those plots that have been abandoned.

1.6.3 Household survey

A household survey involves one person asking another person a list of pre-determined questions on a selected topic using a questionnaire (Assessment capacities project (ACAPS) 2011: 10). The aim of the interview is to ensure that the same questions are asked in the same order across a sample of people representative of a particular population. This has the advantage of making the cases comparable (WFP 2009: 123). My household survey was conducted for representative households that are part of the population of all the active irrigation farmers at New Forest irrigation scheme.

Household surveys are useful for descriptive, explanatory and exploratory purposes (Babbie and Mouton 2011: 232). All these objectives are relevant in my study. The intention is to explore, describe and explain the characteristics of the smallholder farmers based on livelihood variables and demographic features. Surveys have the advantage of enabling researchers to be able to collect original data for describing a population too large to observe directly through probability sampling (*ibid*). Surveys are thus generalizable to the population from which the sample has been drawn, provided probability sampling is used. The disadvantages of household surveys are that non-response can be prevalent, it is difficult to collect and probe sensitive information using a questionnaire, and it is sometimes difficult to verify the accuracy of the information collected before the analysis stage, by which time it is too late to repeat fieldwork (World Food Programme (WFP) 2009: 123).

The household survey was administered to 94 households across the four wards of New Forest village. This represented about two-thirds of the number of the current active

farmers at the scheme. The survey was administered at the irrigation scheme plot to all the plot-holders (both owners and tenants) that were available. The plot-holders not available were followed up on other days. The household survey tool consisted of a 10-page questionnaire that captured information on demographic aspects, income sources, household and production assets, land use, crops grown, harvested and sold, and livestock ownership. This tool is shown in appendix 1.

The questionnaire was developed in part through a literature review of other studies on irrigation schemes in South Africa. These include irrigation schemes in KwaZulu Natal, Limpopo and Eastern Cape provinces (Cousins 2013:131; Fanadzo et al 2010:3515; van Averbek 2012:419; Machethe 2004:59). A reconnaissance visit to New Forest irrigation scheme in May 2013 provided an opportunity to test some of the questions that are relevant to the smallholder farmers. These questions were later refined and improved to ensure that the actual survey process would be much smoother and capture the key livelihood aspects systematically.

The information captured through the household questionnaire appeared to be reasonably reliable. The interviewees freely responded to the questions asked, even though some of the information provided was based on recall rather than records. My introduction to the farmers by the extension staff as a student coming to learn from farmers was also useful. The income data for formal jobs were problematic to collect due to their sensitivity, but in my case there were very few households (only 2%) with members in formal employment.

1.6.4 Crop record sheets

A crop record sheet was administered to the same 94 households which were surveyed to obtain data for each crop they grew, on the area planted, planting and harvesting dates, tillage costs, inputs used (seed, fertilizer, and pesticides), labour use, yields obtained and marketing. This tool is shown in Appendix 2. Of these households, only one household could not recall the agronomic details of crops they planted, and was thus excluded from

analysis. The cropping period considered was 2012/2013. Farmers were able to estimate the area planted to their crops based on the tractor tillage services provided to them. The tillage services included ploughing, disking and ridging. The tillage costs were charged by the irrigation cooperative using standard rates per block of land. The conversion of blocks to hectares was provided by the extension staff.

Seed costs were based on the prices that farmers paid to purchase the seed, while the seeds that were received for free did not have a cost. Farmers were able to recall the quantities used and the unit costs of fertilizers and pesticides. For the farmers that could not remember the unit costs, I relied on the prices cited by others. The type of labour used by the farmers included household labour and hired labour, and the latter included full-time labour and casual labour. Some farmers had knowledge of the quantities harvested and sold for each crop, while others recalled the incomes received.

1.6.5 In-depth life history interviews

Life history interviews are a qualitative research method that uses stories to make sense of complex human conditions, to create order out of competing and contradictory experiences, looking backwards and forwards into past life experiences and anticipating the future (Dhunpath and Samuel 2009: 3). Francis and le Roux (2012: 16) agree that life history research is suited to discovering the confusions, ambiguities and contradictions that make up peoples' everyday lives. The life history interview method was applied within this study of the New Forest irrigation scheme in order to understand the complexity and ambiguities that smallholders' experience, informed by their history of government policies, such as land reform and resettlement, on-farm and off-farm income sources, and family demographic characteristics.

The strength of life history interviews is that they provide a high level of historical depth and ethnographic detail (Lewis 2008: 562). The temporal dimension provides insights into the livelihood trajectory of the household (including relevant material from the experience of previous generations) and their relationship to the wider context. Lewis

(2008: 562) argues that this provides for '*re-historicizing*' our understanding of policy narratives and their impact on peoples' lives. As irrigation schemes in South Africa have been subject to various policies over time, from government-implemented and led production, to irrigation management transfers, to irrigation revitalization, life history interviews enable researchers to trace the impact that these have had on smallholder farmers. The other strengths of the life history interviews are that enabling theories and policies are immersed in the worlds of those impacted by them, and thus help to 'humanize' the research process (Lewis 2008: 562).

The critics of life histories and in-depth interviewing claim that generalizing is impossible, they are time-intensive, there is 'contamination' of data within subject accounts co-produced by informant and the researcher, and there is a danger of telling the story through a researcher with vested interests (Lewis 2008: 563; Boyce and Neale 2006: 4; Patton 2002: 404). In my view these 'weaknesses' of life history and in-depth interviewing are actually the strengths of the methods. They are useful in case study reviews which should not be generalized but unique to the particular situation. Life history and in-depth interviews are also useful when they complement quantitative research methods as in the approach that I have taken.

Although it is important to be purposeful when selecting the subjects for life history interviews, Francis and Le Roux (2012: 18) argue that the number of subjects is not as important as what each participant contributes to understanding. Individual in-depth life history interviews were conducted with 11 farmers that are active in the New Forest Irrigation Scheme. These were purposively sampled to be representative of the villages at the scheme and also show the dynamics and diversity of the types of farmers (i.e. male-headed farmers, female headed farmers, plot-owners, and tenants). Life history interviews were conducted after completing the household survey. The 11 farmers interviewed were selected from the main list of farmers that had undergone the household surveys. Appointments were made with the respective farmers for the most suitable time and venue.

To aid the collection of life histories, I utilized interview guides and tape recorders. The translator later helped me with transcribing the data into English. The information that I collected through the life histories include family history, relocation and land tenure, children, history of farming, alternative income sources, characteristics of successful farmers, and access to agricultural support systems such as the irrigation cooperative, and extension services.

1.6.6 Key informant interviews

Key informant interviews involve interviewing a select number of individuals that are knowledgeable in a particular field under investigation (USAID 1996: 1; ACAPS 2011: 8). The key aspects emphasised in this definition are that the person(s) being interviewed should have first-hand knowledge of the issues being discussed, and these interviews are essentially qualitative and loosely structured in nature, relying on a list of topics in the key informant guide.

Key informant interviews are appropriate to help interpret data collected through other methods, when there is a need to understand the motivation, behaviour and perspectives of the interviewees, and when the main purpose is to generate recommendations (USAID 1996: 1; Kumar 1989: 2). In my study all these criteria were relevant. I needed some context to interpret the household data survey of the irrigation farmers. I needed to understand the perspectives of other role players at the irrigation scheme such as extension staff and other service providers. At a broader level the intention of my study is to generate specific recommendations on improving production and livelihoods in smallholder irrigation schemes.

The strengths of conducting key informant interviews are that the informants provide rich data and insight, since they are knowledgeable about their domains, and are also able to provide information on local incidents or conditions that explain the reasons for the occurrence of things (Kumar 1989: 3). The limitations of key informants are that they may be biased if informants are not carefully selected, they are susceptible to interviewer

biases and it may be difficult to prove the validity of their claims (United States Agency for International Development (USAID) 1996:2; Kumar 1989:4). Patton (2002:321) warns that the danger of using key informants is that over-reliance on them results in one losing sight of the fact that their perspectives are necessarily limited, selective and biased. Triangulation of the information from key informants is thus crucial.

Selection of the appropriate key informants is an essential first step in reducing some of these inherent biases. Key informants selected should have an intimate knowledge of the subject, and individuals should also possess an understanding of the demographic features of the respective population to be interviewed (ACAPS 2011: 10). Kumar (1989:9) advises that the first step is to identify the relevant groups from which key informants can be drawn, and then select a few informants from each group.

Two extension officers from the Department of Agriculture, Forestry and Fisheries (DAFF) served as key informants in the research study. They provided the bulk of the information on extension support services received by the irrigation farmers. Separate semi-structured interviews were conducted with them in order to understand their role, the constraints they face, how long they have worked at the scheme, how they have supported the farmers at the New Forest irrigation scheme, and what solutions are needed, in their view, to improve the conditions and production at the New Forest irrigation scheme. The resident employee of the Department of Rural Development and Land Reform (DRDLR) also served as a key informant for tractor hire services. This informant provided useful information concerning the operation of the tractor services, demand by the farmers, and their relationship with the government.

1.6.7 Focus group discussions

A focus group discussion is defined as a form of group interviewing that assembles a group of individuals confronted by a common issue and is interviewed by a researcher. Gibbs (1997:1) and Kumar (1987:16) distinguish between group interviews and focus groups discussions by emphasizing that in the former, the participants respond to the

questions raised by the interviewer, while in the latter, the emphasis is on group interaction while the interviewer plays a moderating role. A focus group discussion was conducted with the irrigation cooperative committee to understand the organizational set-up and functioning thereof. The interview held with the irrigation cooperative utilized the focus group discussion methodology since the cooperative is already a homogeneous group (structured to serve a similar cause) that works together most of the time.

The purpose of using a focus group discussion is to generate a large number of ideas, thoughts, feelings and perceptions on the same issue from different people within a short time frame (Elliot and Associates 2005:2; Gibbs 1997:2). This is ideal when interviewing the irrigation cooperative to get a broader view on how they see their role at the scheme, and their perceptions with regard to the operations of the irrigation scheme. I-Tech (2008:4) and Kumar (1987:4) argue that good focus group discussions should utilize open-ended questions that begin with ‘what’, ‘why’, ‘how’, ‘when’, and ‘which’. This enables the development of a discussion rather than direct one-word responses like ‘yes’ and ‘no’. In my case I developed a focus group discussion guide that had questions like ‘what is the role of the committee in this irrigation scheme’ and ‘what are some of the challenges that the committee has faced in its work’. The categories of the discussion topics that were discussed included the history of the irrigation scheme, formation of the committee, legal status, its role and members, challenges, successes and future plans. The discussion topics are shown in appendix 3.

The advantages of focus group discussions are that group participation sometimes reduces individual inhibitions, that the respondents are able to raise questions that researchers may not have considered, and that they reveal a broad range of opinions on a topic (Kumar1987: 9; I-Tech 2008:2). The limitations of focus groups are that they are quite difficult to organise, and sensitive information is not easy to obtain through groups, while groups may not be fully confident or anonymous since issues are being shared in a group (Gibbs 1997:3).

The practicalities of conducting a focus group discussion that I considered include which questions are best asked to farmer groups, which groups should be interviewed (in my case it was only the irrigation cooperative), the number of people to interview, and the logistics (appointment, time of day, venue, sitting arrangements, and voice recording). Though most literature proposes that an ideal number of people to interview are between six and ten (Gibbs 1997:4; Krueger 2002:1; Kumar 1987:4), only two representatives of the irrigation committee eventually turned up, as the others were held up by other chores or were travelling. The members of the committee who arrived were the secretary and another committee member. Although group dynamism was absent, the limited number of people in the group discussion provided more time for delving deeper into issues. These representatives showed their deep and broad knowledge of the operations of the cooperative, and of the scheme in general. They also had records of documents for the scheme that proved useful in understanding the cooperative better.

1.7 Data analysis

Data analysis involves re-organising the data into manageable themes, patterns, trends and relationships (Mouton 2001:108). Mouton further contends that the aim of data analysis is to understand the various constitutive elements of one's data through an inspection of the relationships between concepts, constructs or variables. From data analysis, interpretation is the next step that seeks to relate and compare one's data and findings to larger theoretical frameworks and paradigms.

Quantitative data from the questionnaires were cleaned, coded, entered, and analysed using the statistical package for social sciences (SPSS) software. The major analyses conducted include the generation of descriptive statistics, and forms of statistical analysis such as comparison of means and proportions, Chi square tests, correlations, and analysis of variances. Gross margin analysis was also conducted to measure the profitability and productivity of the crops that the irrigators grew during 2012/2013 production year. I compared my findings with national statistics, including the 2011 population census, Mpumalanga provincial statistics and the Department of Agriculture, Forestry and

Fisheries' (DAFF) computerised enterprise budget (COMBUD) crop planting rates, production costs and gross margins data.

Qualitative data recorded in interview transcripts and on voice recorders were analysed through constructing thematic tree diagrams and engaging in comparison of themes (Elliot and Associates 2005:11; Boyce and Neale 2006:7). The data was analysed for themes, trends, and frequently cited and strong opinions. As proposed by I-Tech (2008:5), the range and diversity of participant experiences, perceptions and expressions were also considered in my analysis. In life history analysis, the themes and issues that emerge from the data are arranged into a framework that illustrates the relationship between the different variables and the participants' understanding of history, identity and present situation (Francis and Le Roux 2012:19).

1.8 Study limitations

I encountered four main limitations during the research study. Language was the main barrier, as the majority of the households interviewed spoke Xitsonga and did not understand English or Zulu. To address this constraint I hired a local translator who was able to translate from Xitsonga to Zulu, and *vice versa*. To ensure that we were asking the same question in the same context, we conducted two test surveys with the translator and relied on the extension officer to clarify and translate some agricultural terms from English or Zulu to Xitsonga.

Secondly, since the household survey was conducted at the irrigation plots without prior appointments, households often felt that the interviews took too long to complete and that I was disturbing their work in the fields. In some cases I was not able to find the plot-holders but found only hired workers, and so had to post-pone the interviews. Nevertheless, the plot-holders that I came across were very friendly and cooperative. Only three plot-holders flatly refused to participate in the interviews.

Thirdly, the life history interviews were conducted at the irrigation plots with selected farmers during the appointed days. The constraint that I encountered was very windy conditions that resulted in poor voice recordings of some of the interviews. This was addressed through simultaneous note taking and further follow-ups with the respective farmers.

Fourthly, in relation to missing responses, I was not able to meet the entire irrigation committee and the DAFF personnel based at Thulamahashi. The focus group discussion with the irrigation committee was conducted with only two committee members. Although this was not representative of the entire committee, the small group provided a platform for the free flow of ideas and the full participation of those present.

1.9 Overview of the thesis

The thesis is organised into seven chapters. This is an introductory chapter that has outlined the background of the New Forest irrigation scheme, provided a rationale for the study, listed the key research questions it seeks to answer, and summarised the research design and methods adopted. Chapter Two presents a literature review of smallholder irrigation schemes in South Africa. The focus is on the history of the development of smallholder irrigation schemes in South Africa, land and water policy and tenure, agronomic performance, the theories and discourses of smallholder farming through which irrigation farmers are delimited, and farming's contribution to the livelihoods of smallholder farmers.

The socio-economic profile of smallholder irrigators is presented and discussed in Chapter Three, through an analysis of household demographic features, ownership of assets (household and productive assets), and income sources. The chapter also provides an in-depth review of the socio-economic profile of 11 farmers through case vignettes. Chapter Four explores the irrigation crop production and management aspects in more depth. This chapter looks at land tenure arrangements, access to inputs, labour issues, water management at the scheme, and the economics of crop production (through gross margin analysis).

Chapter Five presents an analysis of agricultural marketing channels through analysis of the farmers' crop value chains and some support mechanisms in place. Chapter Six pays attention to the support systems and services that New Forest irrigators have access to, such as the irrigation cooperative, agricultural extension services, and general support from the government of South Africa. Chapter Seven concludes the thesis by first providing a summary of key research findings, and then discussing the wider policy implications for smallholder irrigation schemes in particular and farming in general.



CHAPTER TWO: SMALLHOLDER IRRIGATION SCHEMES IN SOUTH AFRICA: A REVIEW OF THE LITERATURE

Introduction

This chapter provides a brief literature review of smallholder irrigation schemes in South Africa focusing on the history of the development of irrigation schemes, land reform policies implemented by the South African government, water policies that impact on irrigation schemes, and the agronomic performance of smallholder irrigation schemes. The theoretical frameworks to be used in this study, such as farming styles and livelihood trajectory typologies, are discussed in detail. The section concludes by discussing the contribution of smallholder irrigation schemes to household livelihoods – the key focus of this study.

2.1 History of smallholder irrigation schemes

Smallholder irrigation schemes consist of farm holdings historically located in the former homelands, cultivated by black households, and supplied with water for crop production. In general each plot holder has a plot of up to 5 ha in extent (Fanadzo 2012: 1957). Smallholder irrigation schemes as a whole range from about 30 ha to about 400 ha in size. The objectives of farmers on these smallholder schemes are diverse, ranging from providing a source of cash income to enhancing household food security. The development of irrigation schemes in general in South Africa can be traced back to the early 20th century, when European settlers began to consolidate irrigation farming systems (Tlou *et al* 2006: 7). From the 1930s, blacks were dispossessed of land to make way for state-funded irrigation schemes for whites. At a later stage, from the 1950s, the state developed irrigation schemes for blacks in the ‘homelands’ that were centrally managed by the state.

According to van Averbek (2008: 15) specific approaches to smallholder irrigation were adopted in different eras:

(a) the peasant and mission diversion scheme era in the 19th century, associated with mission activity and emergency of African peasantry in the Eastern Cape.

(b) the smallholder canal scheme era, from 1930 to 1960. The schemes developed during this era were aimed at providing Africans residing in the former Bantustans a full livelihood based on farming.

(c) the homeland era from 1960 to about 1990; these schemes were characterized by modernization and centralized management of the irrigation schemes, and

(d) the irrigation management transfer and revitalization era, that begun from the 1990s and is the current era characterized by change in development thinking and policy.

The objectives of farmers involved in smallholder irrigation schemes are quite diverse both across different schemes and within schemes. The schemes provide some farmers with a place for residence (Van Averbeké 2012: 427), as well as a main food source, or an additional food source and, they provide other farmers with a main source of cash income, while to others they remain a supplementary income source (Van Koppen *et al* 2009: 9). The implications are that one should not take a narrow or one-sided view when assessing the performance of irrigation schemes, as the objectives of farmers are quite diverse, depending on the nature of their livelihoods. Similarly, when agencies are designing interventions in relation to irrigation schemes, the perspectives and needs of farmers need to play a central role in influencing the objectives and expected outcomes of these interventions.

2.2 Classification of smallholder irrigation schemes

Bembridge (2000: xv) classified small-scale irrigation schemes in South Africa in terms of the following 5 types:

- *Top down bureaucratically managed schemes fully administered by government or an agency of government;*
- *Jointly managed schemes on which some functions are performed by the irrigation development agency, while others are the function of project participants;*
- *Community schemes, usually small in size, operated by water users themselves;*
- *State or corporation financed schemes, such as sugarcane, where farmers are selected and government provides infrastructure;*
- *Large estate schemes, State or privately financed, and then managed by agents producing high return cash crops.*

This review focuses on smallholder irrigation schemes that are either self-managed (by smallholder farmers themselves) or managed by another institution where the role of the farmer is limited. Approaches to smallholder irrigation scheme development and management have evolved from government-operated and centralized operations, to irrigation management transfers, to programmes of ‘irrigation revitalization’, which in some instances involved strategic partnerships between plot holders and the commercial partners. All in all, the management of smallholder irrigation schemes in South Africa has generally been authoritarian in nature, despite responsibilities shifting from government to the private sector in recent years (Cousins 2013: 126). The authoritarian approach is evident from the colonial era when the minority-rule government exercised its authority over the schemes via a centralized form of management, which was later inherited by the majority-rule government, before Irrigation Management Transfers (IMTs) and revitalization programmes developed, which have also displayed ‘dictatorial’ tendencies through private sector partnerships (*ibid*).



2.2.1 Centralized operations

Fanadzo *et al* (2010b: 3515) note that many smallholder irrigation schemes in South Africa were initially operated in a centralized estate design, whereby central management enforced control over farming activities with minimal input from the farmers. Farmers thus had no say in terms of what to produce, when and in what quantities. The production system was not ‘owned’ by the farmers as the government dictated all aspects of the system. Carriger and Williams (2003: 3) agree and argue further that this created dependence on the government and farmers were reduced to being workers on their own land, as they did not make any entrepreneurial or managerial decisions. They were given access to land on condition that they produced crops for the scheme. Farmers were fully dependent on the central government that made all the decisions on what to grow, which inputs to use, and marketing methods for the schemes. This approach was partly influenced by the Tomlinson Commission’s report that recommended the centralization of operations (Perret 2001: 3). This system was later abandoned in the late 1990s as the

government realized that it was becoming difficult to cover the high operation and maintenance costs from the fiscus. This led to attempts to transfer the financial burden to the irrigators themselves.

2.2.2 Irrigation Management Transfers

The term ‘Irrigation Management Transfers’ (IMTs) refers to the transfer of the responsibility for managing, operating, and maintaining an irrigation scheme from the government to the farmers and local institutions such as water user associations (van Averbeke, 2008: 18). This approach was adopted in South Africa during the late 1990s (Perret 2001: 6). The main emphases of these IMTs were on capacity building and infrastructural development. The reasons for their establishment in South Africa were to maintain the ‘community subsistence’ function of the schemes (*ibid*: 2001).

In the international literature, IMTs have been deemed successful where irrigation is centrally important in a strongly performing agricultural sector, farm/plot sizes are large enough for farmers to farm commercially, there are strong backward linkages (i.e. input supply systems) and forward linkages (i.e. output markets), and the costs of self-management are not a significant proportion of the gross value of farming output (Carriger and Williams 2003: 1). In South Africa these conditions were not present, resulting in smallholder irrigation schemes collapsing entirely or operating sub-optimally after the IMTs were introduced, especially in the Eastern Cape and Limpopo provinces (van Averbeke 2012: 419). The reasons for this failure in South Africa should also be seen in light of the history of dependence that had been created in the former era of highly centralized operations. Farmers were suddenly exposed to highly competitive input and output markets and the high maintenance and repair costs entailed in these irrigation schemes. No prior capacity building of the farmers had taken place, while issues of financial and technical capacity support were also not considered.

2.2.3 Irrigation revitalization

Revitalization of irrigation schemes is a holistic concept focusing on social upliftment and the creation of profitable irrigation schemes that also benefit the surrounding community (Denison and Manona 2007b: 3). It encompasses the complete overhaul of the ‘hardware’ and ‘software’ components of the irrigation system (Mwendera and Chilonda 2013: 68). The components include the physical (irrigation infrastructure), economic (maximization of profits, and allocation of resources), and social-organization (relationships that deal with legislative, policy, and institutional frameworks) components. Revitalization is broader than rehabilitation, which focuses on repairs and improving the physical structures of the irrigation scheme. Revitalization is still the approach being pursued by government at the present moment and was particularly notable in Limpopo (RESIS and later RESIS Recharge) and the Eastern Cape (Green Revolution) (Tapela 2014: 2; Denison and Manona 2007b: 34; van Averbek 2012: 420).

To make the schemes more profitable, in some locations the government established highly sophisticated agricultural technology such as micro-irrigation and floppy sprinklers, despite overwhelming evidence that such systems were difficult and expensive to maintain and operate compared to gravity-based short-furrow schemes (Cousins 2013: 126).

2.2.4 Strategic partnerships

Strategic partnerships came about through further development of the revitalization concept, whereby plot holders provide their land to commercial partners through formal arrangements (such as contracts, or joint ventures). These commercial partners then farm the land using their own inputs, sophisticated and mechanized equipment and share the profits with the plot holders (Tapela 2014: 4). Strategic partnerships have been cited by Lahiff (2008: 19) as an important new departure for land restitution in South Africa in locations that involve high value land. Although strategic partnership arrangements do provide financial, material, technical and managerial support to farmers, in most cases this has not resulted in the desired incomes for farmers, and in some cases they have been

reduced to land owners that merely ‘observed’ the farming operations of others (Tapela 2014: 13; Tapela 2008: 191; van Averbeké *et al* 2011: 803). Even if the long-term plans are to hand over the running of these farms to the original plot holders, this is doubtful if their capacity has not been enhanced to enable them to be independent.

In direct contrast, Carriger and Williams (2003: 6) contend that while there are examples of failures in contract farming, when successful these partnerships do offer smallholders an opportunity to make their plots profitable. They further argue that what is required is that governments redesign such schemes to enable smallholders to develop stable alliances with input suppliers and marketers of outputs, and to reduce incentives for default on their commitments by both farmers and companies.

Some of the lessons learned on implementing strategic partnerships drawn by Makhathini (2010: 31) include the following:

- a) *Distribution of community benefits. Since the benefits of the partnership should serve the community, it is important to determine how the benefits will be distributed across the different community groups.*
- b) *Negotiating frankly and in good faith. Negotiators need to stick to agreements, being frank and honest, without making promises they would fail to deliver.*
- c) *Owning land versus economic benefit. Empowerment, income and employment are increasingly becoming more important than land ownership. It is critical to determine what the community actually prefers.*
- d) *Doing homework on community needs and circumstances. It is important to gain a thorough grasp of community conditions and dynamics in order to inform interventions*

In summary, if strategic partnerships benefit the larger community, this is more positive than when it only provides monetary benefits to the plot-holders. This is common in other sectors in South Africa now, whereby many private companies invest in the community through social responsibility initiatives. Strategic partners need to live up to their promises, as failing to do so will result in strained relations with the farmers and the

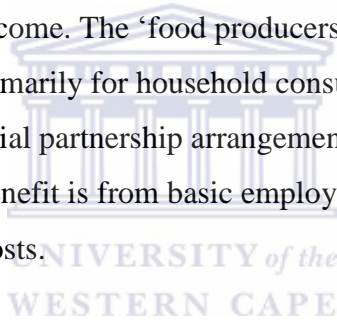
community. The issue of ownership of land versus economic benefit has many aspects. For some, land ownership is seen as empowerment in and of itself regardless of the economic benefits that accrue. For them land represents a place to live, and a site of origins and traditions, and it can be passed on to one's descendants. On the other hand, others see land primarily as an income-raising asset category, while others would prefer to derive income from land-based production. In land restitution claims, for example, some beneficiaries prefer monetary compensation to taking back ownership of land (Makhathini 2010: 21).

2.3 Classification of smallholder farmers

Various stakeholders and researchers have used the following typologies to categorise smallholder farmers:

- The Department of Agriculture's (cited in van Averbek and Mohamed 2006a: 137) 2001 strategic plan for South African agriculture categorized farmers into three groups, viz., 'subsistence farmers' who make up the large majority, 'commercial farmers', which is a small minority, and 'emerging farmers' referring to those with a desire to increasingly commercialize their production. This categorization continues to be used by the Department of Agriculture, Forestry and Fisheries as elaborated in its 2012 strategy document (DAFF 2012c: 33).
- Tapela (2008: 186) categorised farmers as petty commodity producers, subsistence food producers, and commercial vegetable growers.
- Cousins' (2010: 14) class analytic typology distinguished supplementary food producers, allotment holding wage workers, worker-peasants, petty commodity producers, small-scale capitalist farmers, and capitalists not getting their main income from farming. He focused on those engaged in some form of agricultural activity. The key variables that he used were the degree to which agriculture contributes to social or expanded reproduction, and the degree to which hired labour was used in the agricultural enterprise (Ibid).

- Machethe *et al* (2004: 9) identified two categories of smallholder farmers, namely, ‘resource poor farmers’ who have farming and non-farming livelihood activities but whose total assets and annual income are inadequate and they can be labelled as ‘poor’, and ‘middle income farmers’, whose main livelihood source is farming and their assets and annual income is worth more than that for poor households and is fairly substantial.
- Denison and Manona (2007a: 24) distinguish smallholder farmers on irrigation schemes into four categories, i.e, the smallholder, the business farmer, the food producer, and the equity labourer. The ‘smallholders’ have smaller plots, grow diversified crops, take lower risk approaches, need lower water costs, and are typically on flood and smaller schemes. The ‘business farmers’ have larger plots, require land leasing efforts, are more externally oriented with a cash focus, and farming is their main income. The ‘food producers’ have intensive food gardens and grow their crops primarily for household consumption. The ‘equity labourers’ typically have commercial partnership arrangements, joint ventures and share cropping. Their main benefit is from basic employment especially at schemes with high operational costs.



2.3.1 Farming styles typology

A farming style is a structured (or ordered) approach to farming in a specific way that is distinguished from contrasting styles (van de Ploeg 2010: 3). Van de Ploeg (2010: 4) further argues that it is a particular mode of patterning social and material worlds in a coherent and self-sustaining way. Van de Ploeg (cited in Vanclay *et al*, 1998:87) asserts that:

A farming style involves a specific way of organising the farm enterprise: farmer practice and development are shaped by cultural repertoires, which in turn are tested, affirmed and if necessary adjusted through practice. Therefore a style of farming is a concrete form of praxis, a particular unity of thinking and doing, of theory and practice.

Van Averbeké and Mohammed (2006a: 138), utilising van de Ploeg's definition, define farming styles as a particular way of practicing agriculture, combining and ordering activities and elements in agricultural production. From these definitions, a 'farming style' clearly emphasises *order, structure, dynamism and an approach* to farming that is distinguishable across farmer groups.

The literature on farming styles argues for the importance of classifying farming styles, recognizing that farmers are not homogeneous be it through their resources endowments, approaches to farming, management of risks or adoption of technologies (van de Ploeg 2010:1; Vanclay *et al* 1998:85; Schwarz *et al* 2004:33). This helps to avoid a mismatch between farmers' expectations and how development actors (policy makers, extension services, or civil society organisations) play their role in supporting and promoting farmers' development.

Schwarz *et al* (2004: 37) used a farming styles typology to classify farmers in the Wimmera Mallee area in Australia into three groups based on their perspectives, aspirations, and attitudinal and structural characteristics. The farmers were classified into three categories denoted using alphabetic letters W, M and P. The style W farmers were characterised by being cereal/oilseed and pulse producers, having larger farms and higher returns. They had a very positive attitude, a higher level of knowledge and least concerns about the Wimmera Mallee water pipeline. This water pipeline was meant to benefit the farmers' livelihoods.

Style M households had smaller farms, experimental and more likely to have off-farm income. They had a non-traditional approach to farming, were less business-minded and less reliant on the outgoing channel system as a main source of water. Style M farmers had a positive attitude toward the pipeline, but had less knowledge and more concerns than Style W. Increased horticultural opportunities and improved quality of life as a result of the pipeline were seen as important outcomes for them.

Style P farmers had smaller farms than Style W and a mixed farming enterprise (cropping and livestock). They were also business minded, valued the tradition of farming and saw it as a long-term investment. Style P farmers have a positive attitude toward the pipeline but less knowledge and more concerns, than either Style W or Style M farmers. Table 2 provides the characteristics of these farming styles.

Table 2: Selected characteristics of the 3 farming styles for a broadacre system in the Wimmera Mallee water pipeline zone in Australia

Characteristic	Style W (44%)	Style M (23%)	Style P (33%)
Farm Size	Large	Smaller	Smaller
Main farming activity	Cereal/oilseed and pulses	Non traditional	Mixed farming
Income trajectory	Higher income	Off-farm income	Lower income
Farming approach	Business minded, long-term investment, farming background	Less business-minded, farming background unlikely	Business minded, long-term investment, farming background

Source: Adapted from Schwarz *et al* (2004: 37).

This classification of farmer groups in terms of their farming styles enabled the researchers to explain the level of adoption of technologies and reception of extension services based on farmers' characteristics. Although all three farmer groups required the piped water system, its relevance to the livelihoods of the farmers was informed by their disposition, based in turn on their farming style.

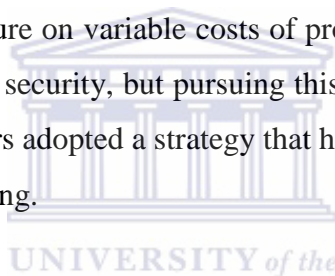
Van Averbeke (2008: vi) and van Averbeke and Mohamed (2006a: 147) also used the farming styles approach to classify farmers in Dzindi, a South African smallholder irrigation scheme in Limpopo, into '*employers*', who were employing extra labour in their plots, '*food farmers*', who were devoted to household food production, and '*profit makers*', who farmed primarily in order to sell crops and generate significant income. Table 3 below shows the farming styles categorization that they developed based on selected farm-related characteristics.

Table 3: Selected farm-related variables characterizing farmer categories at Dzindi irrigation scheme (2002/03)

Characteristic	21% Employers (n=16)	56.4% Food farmers (n=44)	23.1% Profit makers (n=18)
Total variable costs	High	Low	Low to medium
Gross farm income	Low to medium	Low	Medium to high
Type of labour	Full-time farm worker	Family labour and occasionally temporary hired help	Family labour and occasionally temporary hired help
Use of produce	Food for home consumption and sales	Mainly as food for home consumption	Mainly for sales

Source: Adapted from van Averbek and Mohamed (2006a:143).

Van Averbek and Mohamed were able to show that the objectives of these farmer categories were very different. The employers had household food security through production for home consumption as their main objective. This was sought through attempting to recover expenditure on variable costs of production. Food farmers equally had the same objective of food security, but pursuing this through minimizing the risk of losing money. The profit makers adopted a strategy that had a higher level of risk in order to earn cash income from farming.



The classifications above reveal that there is no universal categorisation of smallholder farmers as they are differentiated according to the livelihoods they pursue in both spatial and temporal dimensions. Importantly, they reveal that smallholders are not homogeneous, and should not be treated as such. It becomes critical that governments and development stakeholders not provide a one-size-fits-all approach in policy-making as well as in implementation.

The classification of smallholder farmers should also not be used for developing inflexible or rigid strategies for interventions, as they represent static ‘snap shots’ of farmers’ dynamic and evolving strategies. This is a central argument against an approach or policy that seeks only to support business farmers and generally ignores the majority of smallholder farmers. A farming style typology will be used in this study to profile and understand New Forest smallholder farmers in terms of their assets, incomes, and approaches to farming.

2.3.2 Livelihood strategies of smallholder farmers

A livelihood is simply defined by Chambers and Conway (1991: 5) as a means of gaining a living. They further refer to the World Commission on Environment Development definition that a 'livelihood is defined as adequate stocks and flows of food and cash to meet basic needs'. Livelihood strategies thus combine household's assets in activities that produce different outputs aimed at meeting people's current consumption requirements, and also invested in assets and activities for the future (Dorward *et al* 2009: 3). The livelihood strategies we are interested in are those engaged in by smallholder farmers. Cousins and Chikazunga (2013) define smallholders as 'small-scale farmers who use farm produce for home consumption to some degree, and use family labour within the farming operation to some degree, but for whom farming contributes a highly variable amount of cash income via marketing of farm produce'.

As smallholders are diverse in a number of attributes, they are bound to pursue varied livelihood strategies in earning a living. Dorward *et al* (2009: 4) classified livelihood strategies for livestock producers in Mexico and Bolivia using three basic categories, i.e., 'hanging in', 'stepping up', and 'stepping down'. The 'hanging in' households are those where assets are held and activities are engaged in to maintain livelihood levels in the case of adverse socio-economic circumstances. The 'stepping up' households engage in activities and investment in assets to expand the activities so that production and income increase and improve their livelihoods. The 'stepping down or 'out'?' households engage in existing activities to accumulate assets which in time provide them opportunities for diversifying their activities into other enterprises that become relevant.

Scoones *et al* (2012: 516) also used this approach when seeking to understand in detail the livelihoods of smallholder farmers in Zimbabwe that benefitted from the massive land reform program implemented by the government of Zimbabwe. In addition to the above categories they further added 'dropping out', which was characterized by households that were destitute households, not successful in agriculture at all and abandoning their plots.

These different strategies are associated with identifiable rural classes differentiated by their asset endowments, and socio-economic and political advantages (*ibid*). These classes included asset poor farmers, chronically poor farmers, part-time farmers and semi-commercial farmers.

These proposed livelihood strategy classifications are useful for their explicit recognition of the dynamic aspirations of people, and of differentiation by people undertaking a variety of activities as they mix their strategies and activities in pursuit of their objectives (Dorward *et al* 2009: 5). Scoones *et al* (2012: 519) warn that no typology is ever definitive, and that there are always variations and a blurring of categories as people move between categories over time. Nevertheless, this livelihood strategy classification will be used in my study to understand the production and livelihood strategies that New Forest irrigation farmers pursue in obtaining a living. It will be used to highlight the significant variations in the conditions and potentials of New Forest irrigation farmers.

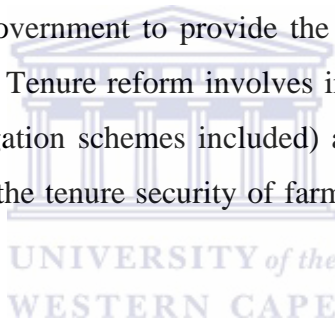
2.4 Land policy and tenure reform

The development of smallholder irrigation schemes should be seen in the light of the history of land and water policy development in South Africa. After white colonialists invaded South Africa in the 17th century (Van Koppen *et al* 2009: 11), racial laws were established that enabled them to dispossess blacks of productive land and in turn settle whites on that land. Various laws were passed such as the Natives Land Act 1913 and the Land Act and Trust 1936 which strengthened white land ownership and restricted blacks to tribal reserves (Woodhouse 2010: 1; Van Koppen *et al* 2009: 11).

The overall goal of land reform in the post-apartheid era is to create social and economic equity by redressing the inequalities of apartheid through the transfer of 30% of white owned land to black South Africans by 2014, which is equivalent to 24.9 million ha (Lahiff 2008: 5). This goal has not been achieved.

Land reform in South Africa embraces three discrete processes, which are land restitution, land redistribution, and tenure reform (Woodhouse 2010: 2). Restitution involves restoration of land to people previously evicted through racially discriminatory laws since 1913. The restitution process had been planned to be completed by 2007, but currently there are many unresolved claims (Lahiff 2008:16). The President of South Africa amended the Restitution of Land Rights Act in July 2014 allowing those that missed the previous deadline of December 1998 to submit claims to land. Restitution of land in irrigation schemes might be important depending on where they are located.

The land redistribution process involves government-assisted purchase of land from white commercial farmers via a 'willing buyer willing seller' process. The land redistribution process has been criticized for being slow and not having the desired impact due to the failure of government to provide the financial and technical support required (Woodhouse 2010:3). Tenure reform involves improving the security of tenure in the former Bantustans (irrigation schemes included) and areas where people will be situated, as well as enhancing the tenure security of farm workers and farm dwellers on privately owned farms.



The main policy trajectory for tenure reform on irrigation schemes has been to transfer individual as well as group rights to the rights holders, but very little implementation has occurred in practice due to both cost and capacity factors (Manona *et al* 2010: 12). Manona *et al* (2010: 13) propose tenure reforms that would entail a statutory (usufruct) right with a certificate held perpetually, and/or a perpetual state lease right in which the state retains ownership, while the holder gets perpetual lease rights.

Reasons that have been cited for variable performance of land reform include poor planning, lack of skills, the absence of adequate post transfer support and an excessive focus on commercial farming systems (Van Koppen 2009:14). These processes of restitution, redistribution and tenure reform are on-going, albeit slowly, and without clarity on policy or strategy.

The standard tenure arrangements at irrigation schemes in the past involved a tribal authority which allocated individual pieces of land with usufruct rights to use. This form of communal tenure led to the issue of 'permission to occupy' certificates. Traditional authorities enforced these and access to land was gendered and unequal (Razavi 2003:4). Though this system collapsed in 1994, it was not replaced by anything else. Land owners thus continue to refer to the 'permission to occupy' certificates in the irrigation schemes located in Bushbuckridge Local Municipality. Land tenure is thus a key issue on irrigation schemes, along with unequal access in relation to gender.

2.5 Water policies and laws

Water policy development in South Africa has also followed a colonial and discriminatory trajectory that favoured the white minority giving them a large share of water usage. Initially the state had overall control to water usage and rights, with individuals holding temporary and revocable rights to water as long as these rights did not undermine industrial/company access to water (Malzbender *et al* 2005: 18-4). This situation later changed as various laws were passed such as the Water Acts of 1912, 1956 and 1998 (Backeberg 2005: 107; Malzbender *et al* 2005: 18-4). Under apartheid riparian (water) rights were attached to land rights and therefore under the control of the landowner. The 1998 Water Act separated riparian from land rights, but allowed licensing for historical use, which meant large-scale water users (commercial irrigation farmers amongst them) continued to have more or less the same access as before, but no longer with ownership of the water. This therefore did not help smallholder irrigators to access more water.

Pre-1994 water policies and laws were developed for ensuring adequate supply of water to irrigation for white farmers, urban centres, and the industrial energy and services sectors (Van Koppen 2009: 18). This has resulted in unequal and unfair distribution of water for farmers engaged in smallholder irrigation schemes. Woodhouse (2010: 1) argues that while access to land showed gross discrimination, the disparities in access to water were even more pronounced. Smallholders lack water for their household and

sanitary needs as well as for agricultural purposes. This could be one of the reasons why there was political will to amend the old water laws.

The South African water sector is facing challenges related to water scarcity, water quality and water-sharing conflicts in river basins (Backeberg 2005: 110). Machethe *et al* (2004: 17) echo Backeberg on the general scarcity of water in South Africa given the various competing needs (industry, manufacturing, mining, residential and farming). Surface water is the dominant source of water supply, accounting for 92% (Backeberg 2005: 108), while water usage by agriculture accounts for between 52% and 59% of all available water (Backeberg 2005: 108; Perret 2002: 4).

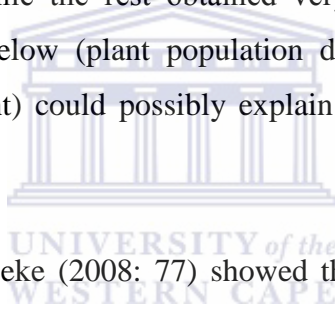
The new Water Act of 1998 was developed in an effort to address the above challenges within the water sector that also spills over to the agricultural sector and irrigation schemes in particular. It sought to address issues of equity, sustainability, representativeness and efficiency through water management decentralization, the establishment of new local and regional institutions, water users' registration and licensing and the emergence of water rights markets (Perret 2001: 2). With the limited availability of surface water (not to mention the various competing users), it is essential to ascertain its adequacy and effective utilization in smallholder irrigation schemes. These issues are further compounded by the ambitious and controversial proposal by the National Planning Commission to increase the area under irrigation by 33% over a ten-year period (NPC 2011: 124)

2.6 Agronomic performance of smallholder irrigation schemes

The agronomic performance of smallholder irrigation schemes is assessed through analysis of crop yields, plant population densities, cropping intensities, soil fertility management and water management.

2.6.1 Crop yields

The benefit of irrigation schemes compared to rainfed agriculture is that the former should provide higher crop yields (as moisture stress is curbed) and create an additional planting season to be taken advantage of. It is disappointing to observe that studies show that the yields smallholder farmers are getting at the irrigation schemes are unsatisfactory (Fanadzo *et al* 2010a: 27; Van Averbeké *et al* 2011:804). When Fanadzo *et al* (2010a: 34) calculated the yield gap at Zanyokwe Irrigation Scheme they discovered that large yield gaps exist between yields achieved by farmers at the scheme compared to those achieved with good management. The average yields for maize, and butternut that farmers were getting were 24% and 22% respectively of the maximum economic yields obtained in on-farm experiments. Only 10 % of farmers were able to attain the “maximum farmer yields” while the rest obtained very low yields (*ibid*). The other agronomic issues discussed below (plant population density, cropping intensity, soil fertility and water management) could possibly explain why smallholder irrigators are obtaining low crop yields.



On the other hand, van Averbeké (2008: 77) showed that farmers at Dzindi irrigation scheme were able to produce positive gross margins for maize when the crop was sold as green cobs rather than dry grain. He also notes farmers were able to obtain higher yields for green vegetables (such as Chinese cabbage) when the crop was planted during months with the lowest daily temperatures (van Averbeké 2008:251). Studies by Cousins (2013: 131) at Tugela Ferry irrigation scheme also showed that 71% of the farmers were able to obtain positive gross margins, with the highest proportions being for maize and sweet potatoes compared to tomatoes and cabbages. Though tomatoes and cabbages are potentially more profitable, they are also highly perishable and thus need a ready market.

2.6.2 Plant population densities and cropping intensities

Crop yields are directly related to the produce (e.g. the size and number of cobs, when considering maize) that each plant will generate. Fanadzo *et al* (2010a: 31) discovered very low plant populations per hectare used by farmers for grain maize (25, 880/ha),

green maize (33, 835/ha), and butternut (18, 200/ha). Other studies also show that smallholder farmers are using very low target plant populations which in turn result in low crop stands (Fanadzo *et al* 2010b: 3518; Bembridge 2000: 33). Machethe *et al* (2004: 59) provide useful information on the high plant population densities utilized by farmers that are also counterproductive, as they would imply high seed costs and a high drain on soil that is not adequately fertilized. It is critical to use optimum plant populations that take into consideration the type of crop, seed variety, water availability and soil fertility of the plots. Unfortunately smallholder farmers may not be aware of these issues, nor those expected to assist and advise them (the agricultural extension workers).

Cropping intensity is shown to be very low at smallholder irrigation schemes (Manona *et al* 2010: 4; Fanadzo *et al* 2010a: 29) which at times translates to farmers utilizing only half of the potential of a scheme (van Averbek *et al* 1998: 124). The only instances of high cropping intensities (closer to 200%) noticed were at irrigation schemes in which farmers were farming through joint ventures with commercial partners, who provided most of the inputs required (van Averbek 2012: 430). This implies that low cropping intensities are due to inadequate farming resources such as inputs, labour, water, etc.

2.6.3 Soil fertility and intercropping

The challenge of soil fertility management by smallholder farmers begins with many of them not knowing the nutrient content of their soil, not having adequate knowledge for managing the fertility of their soils, and not applying adequate fertilizers to their crops due to the high costs of fertilizers. Those with livestock may not be generating adequate quantities of manure needed for irrigation farming. Machethe *et al* (2004: 59), Bembridge (2000: 29) and Fanadzo *et al* (2010a: 33) discovered that farmers at irrigation schemes generally apply very low quantities of fertilizer, with nitrogen being the nutrient most absent in the soils. The mono-cropping of maize, not practicing rotations with legumes, and applying low levels of inorganic fertilizer, further exacerbates the problem of soil fertility management (Machethe *et al* 2004: 79; Fanadzo *et al* 2010a: 33).

2.6.4 Water management

The quantity of water available at irrigation schemes is not always adequate, and not constantly available throughout the year (depending on the water source and the rainfall season). Water scarcity is compounded by the fact that farmers give each other turns to irrigate their plots and thus they tend to over-water their fields when it is their turn to irrigate, due to their fear of not having adequate water in the watering cycle. If irrigation canals are not maintained, they tend to break down, and in some cases develop cracks with time resulting in high water leakages and losses. Perret *et al* (2003: 33) note that in spite of rehabilitation works at Thabina irrigation scheme in Limpopo province, farmers continued to complain about the low capacity of the main canal and a lack of water in winter.

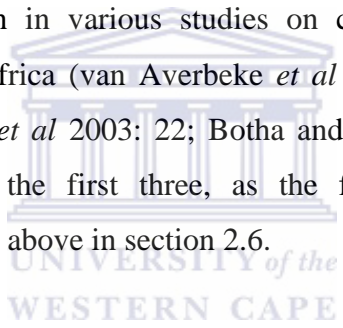
An essential issue related to water management is irrigation scheduling. Irrigation scheduling ensures that adequate water is applied at different stages of plant growth thus preventing over- and under-irrigation of the plots. Studies by Fanadzo *et al* (2010b: 3520), Fanadzo *et al* (2010a: 30), Bembridge (2000: 139) and Machethe *et al* (2004: 79) agree that smallholder irrigators do not practice proper irrigation scheduling resulting in under- or over-irrigation of their crops. This is also related to the fact that the extension officers assisting the farmers may themselves also not have the knowledge on proper irrigation scheduling.

The Limpopo government Recharge programme favoured replacing of canal schemes with modern irrigation technology such as micro-irrigation and floppy sprinkler systems (van Averbek 2008: 20). Denison and Manona (2007b: 36) note that this attempt has had high failure rates in South Africa and is developmentally unsound. The challenges of these new technologies include difficult and costly maintenance required from the smallholders, high energy costs, and lack of community participation in the designs. Denison and Manona (2007b: 3-24; 47) explain that gravity fed canal schemes are more

appropriate and are equally water efficient depending on scheme layout, water management and maintenance of the canals.

2.7 Constraints faced by farmers engaged in smallholder irrigation farming

Smallholder farmers engaged in irrigation production face a multitude of challenges that help account for their poor performance, as noted by many authors. Some of the constraints noted by a study of two irrigation schemes in Eastern Cape and Kwazulu Natal were grouped into four categories: (1) weak institutional and organizational arrangements; (2) socio-economic constraints; (3) infrastructural and water management constraints, and (4) agronomic constraints (Mnkeni *et al* 2010: iii). These points summarize the various constraints that smallholder farmers face in South Africa. These issues are discussed at length in various studies on constraints on performance of irrigation schemes in South Africa (van Averbeke *et al* 2011: 799; Tapela 2008: 183; Bembridge 2000: xvii; Perret *et al* 2003: 22; Botha and de Lange 2005: 3). Particular attention is given below to the first three, as the fourth component (agronomic constraints) has been dealt with above in section 2.6.



2.7.1 Institutional constraints

Weak institutional and organizational arrangements include weak policy, and legislative and governance structures being either not existent or non-functional (Mwendera and Chilonda 2013: 71). Operationalizing the institutional and governance framework entails establishing the formal and informal rules and regulations that guide farmer behaviour. The formal aspects could include the constitution and by-laws under which irrigators operate. The informal aspects include norms, and values such as trust, and care for the infrastructure for the benefit of everyone. The organizational aspects include the various structures that govern day-to-day operations of irrigation schemes such as water user committees, irrigation committee, and marketing committees.

The role of the broader institutional and policy framework is also critical, as these provide an enabling environment for farmers to be productive and receive adequate

support. This includes agricultural policies, financial policies and support through credit, the role of extension, civil society and traditional leadership. Such policies in South Africa include the National Development Plan 2011, the new Water Act (36 of 1998), the National Extension Recovery Implementation Plan for 2008 to 2011, the Comprehensive Agricultural Support Programme (CASP), Broad-based Black Economic Empowerment legislation (Louw *et al* 2008a), and municipal-level local economic development plans. Though these policies might be good and relevant on paper the challenges are always felt at the implementation stage, where there is often no delivery.

2.7.2 Socio-economic constraints

Socio-economic constraints include the socio-economic status of the households, and limited access to markets. The socio-economic profile of a household has a bearing on its ability to be successful in irrigation farming. The variables related to households include ownership of farm and other productive assets needed in production such as farming tools, tillage equipment, and livestock. These assets are not only used in the household but also can be converted into cash (e.g. sales of livestock) and used for purchasing inputs and payment of labour. A component of my study will analyse and determine how household asset endowments have a bearing on irrigation farming. Some studies have shown the influence of social characteristics on successful farming (Chikazunga 2013b: 18; Gomo 2012: 68; Sinyolo *et al* 2014: 151). These attributes include age, education, marital status, household size and gender of household head.

A crucial socio-economic constraint that directly impacts on the income of smallholder farmers is access to markets for their produce (Carriger and Williams 2003: 2-3; van Averbeké 2012: 432). Markets include local sales between neighbours, hawkers, 'bakkies' (pickup truck) traders, and formal markets such as produce markets and supermarkets such as Pick 'n Pay, Spar, Shoprite/Checkers, and Woolworths (Louw *et al* 2008b: 290, 296). Entry into informal markets is easy for smallholder farmers while formal markets have entry barriers comprising required standards, quantity, quality and consistency that smallholders sometimes cannot meet (Louw *et al* 2008b: 288; Tapela

2008: 195; Cousins 2013: 130; Baloyi 2010: 23). This becomes even more pronounced when farmers are a widely dispersed population and not organised via some form of collective action (Chikazunga 2013b: 20; Sahin *et al* 2014: 17). This increases the transaction costs for corporations compared to entering into contracts with large commercial farms.

In an effort to link smallholder farmers to formal markets several approaches have been pursued, such as formation of producer groups and entering into contractual arrangements. Though these initiatives can facilitate smallholder market access and commercialization, there is strong evidence to suggest that they usually favour the wealthiest strata within rural communities (Sahin *et al* 2014: 20; Karaan and Kirsten 2008). The poorest smallholders tend to be excluded in favour of the better-resourced, larger commercial farmers, have greater assets, and better education. Issues that need to be addressed include high transaction costs, knowledge and skills transfer, mechanization, and appropriate and relevant research and development for smallholders.

Chikazunga (2013b: 21) argues for the importance of informal marketing channels since the majority of farmers rely on them and at times large volumes of produce are moved through them. His analysis further showed that in Limpopo farmers supplying these informal markets with tomatoes were getting higher incomes than those supplying 'modern' markets. For perishable commodities such as fresh vegetables, the informal market must be able to quickly move large volumes if farmers are to make a profit; otherwise, they run the risks of high levels of spoilage.

2.7.3 Infrastructural constraints

In South Africa there are currently about 302 smallholder irrigation schemes across 8 provinces that utilize different irrigation systems, such as gravity fed surface, pumped surface, overhead/sprinkler, and micro irrigation (van Averbeke *et al* 2011: 799).

Table 4: Operational status of South African smallholder irrigation schemes in 2011

Province	Number Operational		Number non-operational		Total
	N	%	N	%	
Limpopo	101	59.4%	69	40.6%	170
Mpumalanga	7	36.8%	12	63.2%	19
Northwest	2	100%	0	0	2
Kwazulu-Natal	35	100%	0	0	35
Free State	1	50%	1	50%	2
Northern Cape	2	66.7%	1	33.3%	3
Eastern Cape	51	76.1%	16	23.9%	67
Western Cape	7	87.5%	1	12.5%	8
Total	206	69.6%	90	30.4%	296+6*

Source: Adapted from van Averbeké *et al* (2011: 799).

*the operational status of six schemes, five in Eastern Cape and one in Mpumalanga was unknown.

Table 4 above shows the distribution and the operational status of smallholder schemes in 2011. The majority of these schemes are concentrated in Limpopo, Eastern Cape and KwaZulu-Natal provinces. Not all these irrigation schemes are functional, with the pumped surface and micro-irrigation having the largest numbers that are non-functional. As a proportion, 69.6% of the 296 schemes are functional, 30.4% non-functional and the status of 2% of the irrigation schemes is not known. Even the functional schemes may not be fully operational.

As of 2010, smallholder irrigation schemes covered an area of 47,667 ha, which is very small compared to the 1,675,822 ha of registered (commercial) irrigation land in South Africa in 2008 (van Averbeké *et al* 2011: 797). Around 58% of the area commanded by smallholder irrigation schemes in South Africa uses pumped overhead irrigation systems (van Averbeké 2012: 418). Gravity-fed irrigation schemes have been found to be more durable and last longer than pumped schemes (*ibid*: 432) but only 25% of the command area of smallholder irrigation schemes is under gravity-fed systems, while the area commanded by pumped surface irrigation accounts for 9% of the total (*ibid*: 417). Gravity-fed irrigation schemes have also been found to have lower running costs than pumping schemes (Bembridge 2000:150). Extrapolating from van Averbeké *et al*'s (2011: 799) original table, it can be seen that though gravity-fed schemes are more durable, they are relatively few in number, possibly due to high infrastructural costs of

development as well as being dependent on the dam/river and topography. But consider the proportion that is currently non-functional, number of non-functional overhead schemes (66%) far outweighs the non-functional gravity fed schemes (16%).

Van Koppen *et al* (2009: 25) and Bembridge (2000:150) advocate appropriate irrigation scheme designs for smallholder farmers. Systems that work well for commercial farmers may not work for smallholders. With the advent of the ‘modernization’ paradigm (van Averbeke 2012: 418) that tends to support highly mechanized forms of farming, it is important to ensure that the users will be able to operate, maintain and benefit from irrigation systems. Issues that need to be taken cognizance of include farmer resources, education and literacy levels, farming systems and the dynamics of local social institutions.

Other infrastructural aspects in smallholder irrigation schemes concern the water reticulation system, including dams, reservoirs, canals and valves. These are more relevant to gravity-fed irrigation schemes. Since the Irrigation Management Transfer era, some irrigation schemes have not received any funding from government (the New Forest irrigation scheme in Bushbuckridge, Mpumalanga province, being one example). Here the dam and reservoirs have silted up and the canals are broken resulting in significant water losses. The fences are also broken resulting in problems of cattle grazing in the fields.

2.8 Contribution of smallholder irrigation schemes to household livelihoods

As noted earlier, the objectives of smallholder irrigation schemes are diversified, this being rooted in their past development (in both the colonial and the post-democratic eras); it is also due to the diversity of smallholders, and their dynamic and evolving livelihoods. In order to establish the contribution of agriculture to livelihoods of smallholder farmers it is thus critical to view it from a number of different perspectives.

2.8.1 Multiple benefits from agriculture

Van Koppen *et al* (2009: 9) note that as many as 23% of all black households in South Africa are engaged in agriculture, though it may not be the main source of their income. The majority engaged in agriculture use it to provide an extra source of food rather than as the main food source. A minority of farmers are in agriculture in order to get an extra income source, and even fewer have agriculture as their main income source (*ibid*). (These statistics apply to all black rural households and not just to those on irrigation schemes.) Perret (2002:7) estimates that two thirds of smallholder irrigation farming in South Africa is dedicated to food plots, the objective being subsistence, a significant number of households being dependent for a livelihood on such schemes, at least partially. For the majority of these households, farming provides an additional source of food (van Averbek 2012: 414).

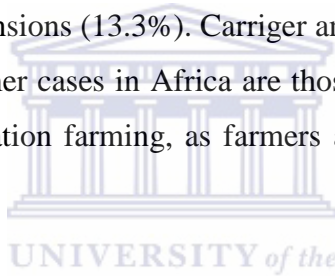
The importance of the contribution of crops from irrigation scheme plots to household food consumption does account for the type of crops that are generally grown. Most smallholder irrigation schemes typically grow staple maize and vegetables. These crops contribute to meeting household food needs, and the excess can then be sold. Subsistence farmers continue to grow maize even when they are aware that it is not as profitable as other (high value) crops, because they know that their household needs will be met (Machethe *et al* 2004: 78; Bembridge 2000:19). The other reason could also be that maize does not require elaborate agronomic skills or inputs compared to other high value crops. Most irrigation schemes are not operating as commercial ventures. There are farmers in irrigation schemes with the objective of producing food for the homestead, while others produce cash crops. It is critical to see how strategies can be differentiated to meet these differing needs.

2.8.2 Off-farm income sources and diversified livelihoods

Plot holders on smallholder irrigation schemes do not rely exclusively on income from agriculture, and off-farm income at times outweighs by far the income from farming. Access to off-farm income is critical not only for livelihood resilience but also to

capacitate the irrigation farm enterprises of smallholder farmers. Off-farm income includes salaries and wages, social grants, income generating activities, credit and remittances (Kirsten and Moldenhauer 2006: 73; Food and Agriculture Organization (FAO) 1998). The sources of off-farm income are important in contributing to increased farm production (Sinyolo *et al* 2014: 152). Sinyolo *et al's* (2014:153) study in Kwazulu-Natal established that access to credit support ensured that farmers secured inputs on time, leading to improved agricultural output and increased farm revenue.

Some plot holders have household members who are formally employed, and thus able to provide some money for purchase of the agricultural needs of irrigators, e.g. inputs. In his study of the Tugela Ferry scheme in KwaZulu-Natal, Cousins (2013: 132) discovered that the income sources of plot holders consisted of farming (33%), jobs (22.9%), child support grants (20.8%), and pensions (13.3%). Carriger and Williams (2003: 4) argue that the majority of successful farmer cases in Africa are those deriving a significant portion of their livelihoods from irrigation farming, as farmers are willing to commit time and resources to it.



Social grants such as pensions and child support grants play a significant role in financing agriculture for households that have access to them. The reach of social grants from the government has improved in recent years, resulting in an increase in household income levels and ensuring their survival (Van Koppen *et al* 2009: 7; Tapela 2008: 188). Analysis of household datasets in South Africa shows that social grants support development, poverty reduction, improved nutrition, health, and education for recipients and their families (Neves *et al* 2009).

Cousins (2013: 128) maintains that child support grants and old age pensions are an important income source for many smallholder farmers. Neves *et al* (2009) argue that recipients are enabled by these grants to hire equipment and purchase agricultural inputs and thus increase net return to farming by as much as 52%. One drawback of social grants noted by Tapela (2008:194) is that they tend to make local labour expensive. This makes it difficult for farmers to hire additional labour for their farms and rely mainly on

foreigners who accept lower wages due to their illegal status and limited livelihood opportunities and income sources.

2.9 Conclusion

This chapter provided a review of the literature of smallholder irrigation schemes in South Africa. It began by offering a historical account of smallholder irrigation development in South Africa from the 19th century, when the focus was on peasant and mission diversion schemes. This was associated with mission activity and the emergence of an African peasantry in the Eastern Cape. This progressed to the current phase that centres on irrigation revitalization programmes that focus on social upliftment and making irrigation schemes more profitable to smallholder farmers.

The policies that govern the management of smallholder farming in irrigation schemes, such as land reform, tenure reform and water policies were looked at from a historical perspective. The current influence of these policies in small-scale farming in general, and irrigation farming in particular, was elaborated on. Emphasis was given to the agronomic performance of smallholder irrigation schemes as this has a bearing on the livelihood of the irrigation households and on how policy makers judge the contribution of irrigation schemes.

Theories on farming styles and livelihood strategies pursued by smallholder farmers were discussed and their usefulness to the study of smallholder irrigation schemes assessed. A 'farming style' is a structured approach of farming in a specific way that is distinguished from contrasting styles. It accounts for why certain farmers behave the way they do, compared to other 'similar' farmers. The livelihood strategies engaged in by smallholder farmers include 'hanging in', 'stepping up', 'stepping out', and 'dropping out'. These livelihood strategies, although neither cast in stone nor rigid, are useful for the explicit recognition of the dynamic activities and aspirations of smallholder farmers.

A summary of the constraints faced by smallholder irrigation farmers was provided to show that these are numerous and generally categorized into institutional aspects, socio-economic constraints, infrastructural aspects, and agronomic factors. Although this review seems to provide a gloomy picture of the status of smallholder irrigation schemes in South Africa, there are studies cited that note the positive benefits of smallholder irrigation schemes. Indeed there are multiple benefits from irrigation schemes that can be observed from the diversified objectives of farmers engaged in irrigation farming.



CHAPTER THREE: SOCIO-ECONOMIC PROFILE OF NEW FOREST IRRIGATORS

3.1 Introduction

This chapter provides the socio-economic and demographic profile of New Forest irrigation scheme farmers and compares this to the profile of the Bushbuckridge Local Municipality in which the scheme is located. The emphasis is on a descriptive analysis of household characteristics, the types and numbers of assets owned, livestock ownership, and the different income sources available to the households. The purpose of the chapter is to understand the wider socio-economic and livelihood context within which irrigation farming at New Forest is practiced.

3.2 Bushbuckridge Local Municipality

According to the Bushbuckridge integrated development plan (Bushbuckridge 2013:23), their 2011 census data show that the total population of Bushbuckridge Local Municipality is currently 541, 248, with 134,197 households and 53,204 agricultural households (which comprise 40% of all households in the municipality).

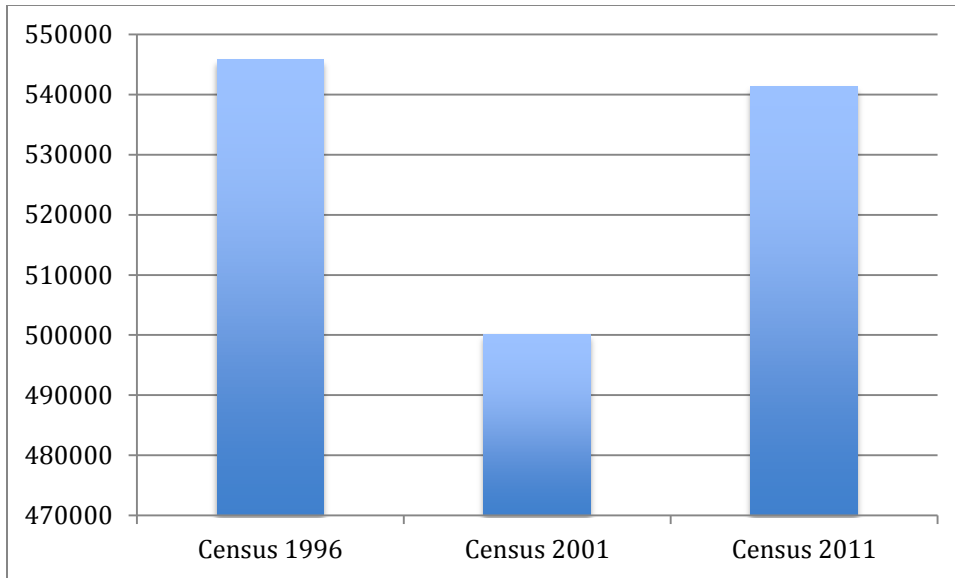


Figure 4: Population trends in Bushbuckridge Local Municipality, 1996 to 2011 (Source: Adapted from Bushbuckridge 2013:23 census data, 1996, 2001, 2011)

Figure 4 shows the variable trend in the population census figures between the years 1996, 2001, and 2011. The variability in the figures across the years suggests that the municipality is subject to high population mobility by virtue of its location and socio-economic characteristics. Other contributing factors might be variable fertility and mortality rates, the very high unemployment rate (52.1% of all economically active adults), and immigration into the municipality from neighbouring countries such as Mozambique and Zimbabwe (Bushbuckridge IDP 2013/2014: 23).

In sex ratio data a percentile proportion of less than 100 implies that there are more females than males in the population. The sex ratio between females and males shows that there are generally more females than males in the Bushbuckridge Local Municipality. This has been the case for the last 20 years, as shown in the population census data in Table 5. This proportion has not changed significantly since 1996.

Table 5: Sex ratio in Bushbuckridge Local Municipality

Census Year	%
1996	83.00
2001	81.94
2011	83.33

(Source: Bushbuckridge 2013:28 census data for 1996, 2000, and 2011)

Data on the demographic characteristics of households in Bushbuckridge Local Municipality are presented below.

Table 6: Demographic characteristics of Bushbuckridge Local Municipality

Characteristic	Proportion
Sex	Males = 45.5% Females = 54.5%
Unemployment rate ⁵	52.1%
Youth unemployment rate	64.6%
Average household size	4
Households with access to piped water inside the household	11.9%
Households with a flush toilet connected to a sewer	6.8%
Households with access to electricity for lighting	93.9%

Source: Statistics South Africa website 2014, http://beta2statssa.gov.za/page_id=993&id=bushbuckridge-municipality.

The municipality has a high unemployment rate of 52%, while the youth unemployment is even higher at 64.6%. From the in-depth interviews that I did it appears that very few

⁵ A person is unemployed if he or she desires employment but cannot find a job. The unemployment rate is then obtained by expressing the number of unemployed persons as a percentage of the total number of people willing and able to work (the so-called labour force). Source: Statistics South Africa 2012:48.

youth are involved in irrigation farming at New Forest. The majority of the youth appear to prefer to seek formal employment in other sectors of the economy.

Access to sanitation is also low, as access to piped water inside the household and the proportion of households having a flush toilet connected to a sewer is also low. Access to electricity though is very high at 93.9%. In relation to social identity, Xitsonga is the main language spoken by 56.8% of the population in the municipality, followed by Sepedi (24.5%), and Siswati (7.8%). Even fewer households speak other languages such as Zulu, Sotho, and Ndebele.

3.3 New Forest village and irrigation scheme

New Forest village has a very high unemployment rate, with most households relying on small-scale farming, social grants and remittances from relatives in urban areas (Mnisi 2011:16). The village's main wards that are served by the irrigation scheme include New Forest, Tsuvulani, Demulani and Edenberg wards. There are also Reconstruction and Development Program (RDP) houses located in the village. Thulamahashi Township is the township located closest to the New Forest irrigation scheme. The township contains major government services such as the South African Police Services, the departments of Home Affairs, Agriculture, and Transport, as well as primary and secondary schools. The shopping complex at Thulamahashi Township contains major hardware, clothing and retail shops, the main banks, and a large taxi rank that serves various destinations such as Hoedspruit, Nelspruit, and Bushbuckridge.

3.4 Household characteristics of New Forest irrigation farmers

3.4.1 Household composition

Table 7 below shows the main demographic features of New Forest irrigation farmers within the sample of 94 households. The mean household size (6) at New Forest is larger than the mean household size in the local municipality, which is 4 household members.

There are almost equal number of females and males in these households, though the number of adult females is slightly larger than that of adult males. The data from the Statistics SA 2011 census show that the Bushbuckridge Local Municipality has households with a ratio of 54.5% females and 45.5% males. This closely mirrors the proportion of males and females at New Forest irrigation scheme (females are 57.6%, while males are 42.4%). Children in New Forest account for the 43% of the total household population. This includes only the children that live with the household members most of the time.

Table 7: Household demographic features at New Forest irrigation scheme (n=94)

Variable	Mean	Median	Sum	Range
Household size	6	6	565	2-14
Number of females	3	3	293	1-8
Number of males	3	3	273	0-9
Number of adult females	2	2	162	1-6
Number of adult males	1	1	119	0-6
Number of children	2.5	2	215	8

3.4.2 Marital Status

The majority of household head irrigators at New Forest irrigation are married (54.3%) but there are also a high proportion of widows and widowers (30% of the total). The high proportion of widows is consistent with the high mean age of household heads, which is 60, showing that the majority of irrigators are senior citizens. The fact that there is this senior age group amongst household heads brings the advantages of experience and well-developed networks in the community. Its drawback is the inability of older people to adopt and take up new technologies and skills quickly, compared to those in a younger age group. Very few irrigators are divorced, separated or single. Table 8 shows that when these statistics are compared to the municipality statistics, the pattern is reversed. At the municipality level, the 'single' category constitutes the highest percentage of individuals, while there are few that are married.

Table 8: Comparison of the marital status of household heads at New Forest (n=94) to the Statistics SA census of 2011 for Bushbuckridge

Marital status	New Forest irrigation (n=94)	Bushbuckridge local municipality*
Married	54.3%	12.8%
Living together not married	**	7.8%
Widow/Widower	30%	4.2%
Divorced/ separated	6.4%	1.3%
Single/Not married	9.3%	73.9%

*Source: Statistics South Africa 2014 web site on population census 2011.

** It could not be clearly established whether or not there are any households of this type

The majority of household heads at New Forest are male (61.7%) as shown in Table 9 below. The mean age is not very different (59 years compared to 60 years) across the sexes of the household heads. The majority of male household heads are married (87.9%), while the majority of female-headed households (66.7%) are widows. The high proportion of widowhood amongst women has a negative impact on household's access to alternative income sources such as formal employment, social grants and additional household labour.

Table 9 also shows a higher number of single females or single parents but not married (22.2%) when compared to males (1.7%). This could be explained by the fact that the majority of males, especially the youth, leave home in search of off-farm employment in the big cities of South Africa. The mobility of women, on the other hand, is quite limited.

Table 9: Marriage status of New Forest irrigation scheme household heads by sex (n=94)

Marital status	Males (n=58)		Females (36)	
	Mean age	%	Mean age	%
Married	58 years	87.9%	-	-
Widow/widower	69.7 years	6.9%	63.5 years	66.7%
Divorced/separated	71 years	3.4%	55 years	11.1%
Not married/Single parent	-	1.7%	48 years	22.2%
Combined	59 years	61.7%	60 years	38.3%

3.4.3 In-depth profile of eleven (11) New Forest irrigation farmers

Individual, in-depth life history interviews were conducted with 11 farmers that are active in the New Forest irrigation scheme. These were purposively sampled to be broadly

representative of the villages at the scheme and also show the dynamics of livelihood change as well as the diversity of the types of farmers present.

3.4.3.1 Description of the 11 New Forest irrigation farmers

Below is a brief introduction to the 11 farmers in terms of their demographic characteristics, size of irrigation plots and income sources. Their real names have been changed to protect their identity. A detailed analysis of pertinent issues that affect their livelihoods such as forced removals, land tenure, access to water, inputs markets and agricultural support systems was undertaken, combining these qualitative data with quantitative household survey data in the following chapters. This section thus helps to provide a historical perspective and a more in-depth understanding of the social context of the New Forest irrigation scheme. Appendix 4 displays the demographic, socio-economic and cropping characteristics of these households.

Kenny

Kenny, a 67-year-old man, was born and grew up in Rolle, which is located adjacent to Thulamahashe Township. When he turned ten he stayed with his family at New Forest village. His father had two wives. The children of his mother were seven brothers and two sisters. Two of his brothers have passed away while the other four are farmers at this irrigation scheme, with varied success rates.

His father used to farm sugar beans, groundnuts and maize under dry land. They also had a large herd of cattle. Kenny is married and has seven children, one boy and six girls. He also has three grandchildren staying with him. Three of his children are working, one as a clerk, one as a teacher and the other as a rigging engineer at a nearby mine. One child is studying at Vaal University, and Kenny sends him R800 monthly for his upkeep, while the other did not do well at school and is ‘making babies’ at home. The two youngest of his children are still at school.

Kenny and his family started irrigation farming as an income-generating activity in 2002. He is not aware of the size of his irrigation plot. During that period he was formally

employed so his wife did most of the farming. When he retired in 2006 he joined his wife in farming, and that was the period when they began to realize a substantial income from farming. The period before his retirement was the least successful in relation to farming. The first crops they farmed included tomatoes, cabbages and maize, but now they are producing mainly spinach and maize. However, during 2012-2013 he planted maize and cabbages.

Mary

Mary is an elderly woman who was born in Maputo, Mozambique in 1965. Her father had two wives. She decided to come to South Africa in July 1992. In that same year she was married to a South African that lived in New Forest village. Her mother tongue is Xitsonga, which is the main spoken language in the New Forest area. After her marriage she decided to settle in South Africa. She has two female children, one of which passed her matric while the other is studying grade 11 at a local school. The elder child that passed matric is not working at the moment. Mary's spouse is employed locally and assists with purchase of food for the household and school fees for the child. The salaried income also assists the family with purchase of inputs for farming, including the costs of hiring a tractor.

Mary started farming at New Forest irrigation scheme in 2003. She has one plot of 1.4ha. The main purposes of farming are food production and generating cash income from the sale of excess produce. In 2012 she received a bumper harvest of maize. She was able to sell a large quantity of fresh mealies and also keep some maize for her mealie meal. The other crops that Mary grew in 2012 were sweet potato, spinach, pumpkin leaves and okra.

Angela

Angela, an enthusiastic woman, was born and grew up in her father's house in Maputo, Mozambique. They were three sisters and three brothers of whom only one brother is still alive. Angela's father migrated with his family to work in Johannesburg, South Africa around 1983. This was the time when they fled the civil war in Mozambique. He stayed with his family in Thembisa Township, Johannesburg at the time. Two of Angela's

siblings are working, one at Phalaborwa and the other at Bisont. The other sibling is staying with her at New Forest village and assists her with farming.

Angela is a single parent with four children, comprising three girls and a boy. All but one of her children is not working. The working child is a local taxi driver (who is matriculated and looking for a better job), while the youngest one is still at school. One of her daughters is now married and lives with her husband. Angela also has two grandchildren staying with her. The size of the plot of land that Angela has rights to is unknown, but it is less than a hectare.

Thabisile

Thabisile is a young single parent who is known and envied by most farmers at the New Forest irrigation scheme. Thabisile was born in Tsuvulani village in 1967. She grew up in a large family with 12 children in total. Three of her siblings are no longer alive, one working in Johannesburg while others still live in their late father's homestead in Tsuvulani. The majority of her siblings are surviving through social grants (pension, disability and child grants). Thabisile is the only member of her family engaged in farming at the irrigation scheme. Though she has tried to encourage her siblings to join in farming, none has been able to do so yet.

Their parents brought them up through farming at the irrigation scheme and their father was working for the government at the time. Thabisile currently has three children. The eldest child is working in Nelspruit, the second one works with her in the irrigation scheme, while the youngest is still at school.

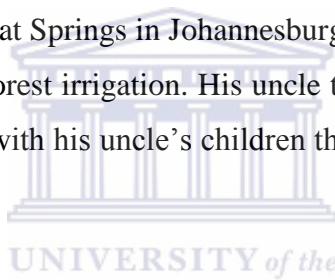
Thabilise moved out of the family village when she got married in 1986 and had a child in that year, but was later divorced in 1998. After the divorce Thabilise returned to her parent's homestead. She began actively farming with her mother and later took over the irrigation plots after the parents passed on. This was the time she also built her own homestead outside her father's homestead. Thabisile's mom also used to be involved in a

group poultry project that gave her some income. She attributes her passion for farming and the skills that she learnt to her mother whom she farmed with in the past.

Thabilise began farming at the irrigation scheme after 1998 when she used to plant maize, groundnuts and tomatoes. Besides irrigation income, the other income sources at Thabisile's disposal include poultry production, in which she sells about 400 broilers every month. She also sells brooms. According to her, irrigation is her highest income earner.

Derick

Derick, a passionate middle-aged man was born in Dinglydale area in 1963. In his father's family they were four boys and one girl. Two of his siblings are late, while the others are staying and working at Springs in Johannesburg. Derick grew up with his uncle who is also a farmer at New Forest irrigation. His uncle taught him all the farming skills that he knows. As he grew up with his uncle's children they used to farm between school and after school.



Derick is married and has four children of his own, while one is late. One of his children is doing a sowing course through the Zion Christian Church, while his eldest son is looking for a job in Phalaborwa. This son has failed standard 10 twice after which Derick assisted him to get a code 10 driver's license and public driving permit. His other children are still at school. His youngest child is doing grade 7. None of his children like farming.

Farming income is his major income source through which meets all the needs of his household such as food and school fees. He also gets a child grant for two of his children. Derick started farming in 2007 for household consumption and selling excess produce. His plot size is 1ha. He recalls that 2012 was the most successful farming year. He received enough money that enabled him to complete the construction of his house, put ceramic tiles and purchased some furniture for his house. During that year he had planted

maize, butternuts, spinach, cabbages and chilies. Maize was sold to 'bakkie' traders, butternuts and spinach to hawkers, while cabbages and chilies were sold to Pick and Pay.

Allan

Allan is one of the few farmers renting from plot holders that are not using their land. He is 49 years old and grew up in Jembeni area. He comes from a large family as his father had eight wives and so many children. From his mother's side there were five children, three girls and two boys. All his sisters have been married and live different locations of South Africa. Allan is currently staying in Orinocco A where he was born. His parents did not get any fields in New Forest irrigation since they are not from the area.

Allan was married in 1989. He has five children of which three are still at school while two are working temporary contract jobs in Johannesburg. He also has a grandchild staying with him. Allan in the past used to work in the mines before retrenchment. He then decided to pursue farming at New Forest irrigation scheme as he saw that there were large tracks on underutilized plots.

He feels very insecure about the rental arrangement as the landowner can withdraw his plot anytime without prior notice. He recalls an instance in which he identified a plot that had not been used for some time and negotiated with owner who borrowed him the plot. After he had hired labour, cut down trees and cleared the plot for farming the owner withdrew the plot from Allan even before planting the first crop. Currently Allan is renting 1ha of land from a plot owner. The crops that Allan grew in 2012 are maize and tomatoes that he sold to 'bakkie' traders.

Phineas

Phineas, a Sotho man, was born and grew up in Malalane in KwaShongwe during 1953 to a family of four children all boys. All his brothers are now late. When his father died his mother got remarried and moved with him and his siblings to Tsuvulani village. His family did experience forced removal from their land and homestead in Malalane (Komatiport) where they were forced to live close together in a sort of township fashion close to neighbours with restricted fields and grazing areas.

His mother is still alive and stays with him at his homestead. Phineas got married in 1991 and has six children who are all at school, and two grandchildren. One of his older children is studying electrical engineering at a college in Phalaborwa. His family came to New Forest in 1987 after the death of their father. Phineas got a homestead in Tsuvulani through application to the government and was allocated the fields that corresponded to the village homestead. During that period it was easy to obtain land if one needed it for farming and settlement.

Phineas used to work for a company in Welkom that later moved to China in 1996 and found himself jobless. It was then that he decided to be an active farmer. Phineas has two plots, one that is 1.2 ha that was inherited from his mother (that she inherited from the second husband) and another 1.4 ha, which he got himself from the government through the assistance of his stepfather. During the year 2012 he grew maize, tomatoes, cabbages and groundnuts in his plot. He sold his maize to 'bakkie' traders, while the rest of his produce was sold to hawkers.

Sam

Sam is a widower born in Demulani village during the year 1950. Five children were born to his parents and they are all still alive. Two of his siblings are working in Johannesburg while his two sisters are staying in their matrimonial homes. He has three children that are working in Johannesburg and only come during the holidays. His children do not like farming at all. His two children staying with him are still looking for jobs. He is also staying with two of his grandchildren that are going to school.

His wife died in 2007. Sam finds it difficult to farm alone. Sam used to be a driver with a bus company in Pretoria before he retired. After his retirement, he and his wife were given the plot to farm by his in-laws in 2005. The plot that he has measures 1.2 ha. The in-laws did not utilize the plot as they are working. During the year 2012, Sam grew maize and tomatoes in his plot that he sold to 'bakkie' traders. The income sources that Sam has include pension and income from irrigation farming.

Janet

Janet is a single parent that was born at Chochocho in 1936 to a family of children. One of her sibling is late while the others are staying in Mbumbumbu where they were resettled from Chochocho by the white minority government in 1972. The displacement affected her family as the homestead they had built in Chochocho was destroyed and they were forced to rebuild another one at Mbumbumbu without any assistance. Janet inherited the land on the irrigation scheme from her father who had been given by the government in 1972 during the resettlement period. Her current land holding is 1.3 ha.

During the year 2012, Janet planted maize, groundnuts, bambara nuts, and sweet potatoes in her irrigation plot. The groundnuts and sweet potatoes were sold to hawkers; the maize was consumed at her household, while she did not harvest any of her Bambara nuts. The market for her produce is a real challenge that she battles with every time. Janet's income sources are the pension, child grant and sometimes farming when she is able to get a good harvest. With this income she uses it to purchase inputs for farming and food.

Janet was never married and has two children one not working and another on maternity leave, and one grandchild. Her children do help her in the fields when they are available.

Rose

Rose, a married woman and mother of three children was born in 1957. Her father and mother had eight children in total comprising of four men and four women. All her brothers are late. Her sisters are staying in Hlubukani where they do not have access to irrigation plots and so not involved in any farming activities. Her children are still at school. She also lives with her mother in law.

Rose does not own any fields but was borrowed the 1.2 ha plot she is using four years ago. She works the plot with her husband, though the husband spends most of his time tending the garden that they have. The purpose of borrowing the irrigation plot was for farming in order to earn an income. Farming and pension are the income sources for her household. In year 2012, Rose had planted maize, groundnuts, bambara nuts, and sweet

potatoes. The maize was eaten by her household while the other crops were sold to hawkers. From the irrigation she has been able to get adequate food and money to purchase additional food for her household, send children to school and purchase of farm inputs.

Musa

Musa serves the irrigation cooperative on a part time basis as its treasurer. She was born in Dinglydale in 1968. Her parents had eleven children. Her father is late while her mother is still alive. Her mother is staying at the family homestead in New Forest where they were settled from Dinglydale in 1973 by the former government. From eleven of her siblings, seven are remaining. Her sisters are living at their matrimonial homes while three of her brothers are working locally.

Musa got married and moved to her matrimonial home in 1987. Her husband works at the department of works in Thulamahashi. Musa and her husband have two children; one is training in nursing and computers, while the other is in her 4th grade at the local primary school. Musa believes that her children will love farming as they grow and the older one does help her with farming every now and then.

Musa started farming at the irrigation scheme in 1988 when her father told his children that he was old and had to retire from farming. He handed over to her the 1.4 ha plot. She also cleared a piece of land measuring 1ha adjacent to the official plots. In comparison to her siblings she was the only one prepared to farm and has been farming ever since. When she started farming for sale she grew maize and tomatoes, now she is growing maize, tomato, cabbage and butternuts. In 2012 Musa planted maize, tomatoes and butternuts in her plot. The maize and tomatoes were sold to 'bakkie' traders while butternuts were sold to hawkers.

Farming is her only income source though she does at times receive money from her working husband. Income from farming has enabled Musa to see her children in school

and the older one through tertiary education. She was also able to take care of the family when her husband was not working before the year 2000.

3.5 Assets ownership

One proxy measure of wealth status that is used to differentiate households is the number and types of assets owned. The New Forest irrigation farmers were assessed in terms of the asset ownership across domestic, electronic, transport and agricultural assets. Domestic assets include the assets generally used in a household for every day functioning such as electric stoves, microwaves, sewing/knitting machine, washing machine, lounge suit, gas stove paraffin stove, and a fridge. The electronic assets are basically communication assets such as a radio, a compact disk player, a television, and a computer.

The transport assets include a motorcycle, bicycle, and a motor vehicle. These assets would provide mobility to a household to travel from point A to point B either for commercial, or for social reasons. The agricultural assets include tractor, plough, wheelbarrow, knapsack sprayer, donkey cart, garden spade, garden fork and a hoe. Farmers use the agricultural assets in the agricultural production process. These are the tools of the trade that make farming possible.

Table 10: Asset ownership by households in New Forest irrigation scheme (n=94)

Asset type	Mean	Median	Range	Total number of households owning	
				n	%
Domestic	4.8	5	2-9	94	100
Electronic	2.3	2	0-5	88	93.6
Transport	0.4	0	0-2	34	36.2
Agricultural	6.6	6	1-17	94	100
Total	12	12	2-24	94	100

The majority of households generally owned most of the domestic assets. A low percentage of households that did not have access to electricity did not own the electrical domestic assets. As shown in table 10, on average 4.8 of the potential 8 domestic assets

were owned by the irrigators. This constitutes about just over half of all the domestic types of assets. All the households (100%) at least owned a domestic asset. The importance of domestic assets is that they provide utility to households in terms of comfort and lessening domestic chores (usually done by women) such as cooking, and washing. As households become affluent, they tend to acquire more domestic assets. So this is a proxy measure of prosperity.

Almost all the households (93.6%) own at least an electronic asset. On average 2.3 assets are owned by the households out of the 4 possible electronic assets owned, representing about two thirds of the electronic asset types available. This shows a better ownership level compared to the domestic assets. The importance of electronic assets is that they facilitate communication, information, and entertainment. The later role also fulfils a social status role in the society. The least owned electronic asset is the computer, which was owned mostly by the children of the irrigators rather than the irrigators themselves, though this was also a low ownership percentage (7% of households).

36.2% of the households own transportation assets. Though this is low, it is quite significant. None of the households interviewed owned motorbikes, while only 6.4% owned bicycles. Vehicles comprise the highest owned transportation assets, as they are owned by 30.9% of households. Of these households, only 1 household owns 2 cars while the rest own a single vehicle. The irrigation scheme is located in an accessible area near the main road to Thulamahashi and the other major town centres. The road is also served by a reliable and frequent public transport system such as buses and taxis. Owning a vehicle in this case provides the independence, convenience and flexibility for irrigators either to carry inputs or their produce to various markets. Bulk purchasing is also possible if the vehicles owned by the farmers are pick-up trucks. The few vehicles that I saw at the irrigation scheme belonging to irrigators were pick-up trucks though I could not establish how many vehicle owners had pick-up trucks.

All households owned agricultural assets though in different proportions. The mean number of agricultural assets owned is 6 out of 8 agricultural asset types. The very

similar mean and median number shows that asset ownership is not skewed, thus a good representative figure of agricultural assets owned on average. This high ownership reveals that New Forest households are farming households. The range (1-17) shows that there are households with very few agriculture assets owned, while some households have a high number of assets.

Tractors and donkey carts are not owned by any of the households. As will be shown in the next section, households generally own few draft livestock. Correspondingly, ploughs are owned by 3% of the households. This accounts for the over-reliance of the irrigation households to tillage services provided by the irrigation cooperative. When the irrigation cooperative fails to provide tillage services for any reason this implies that farmers would not be able to plant their crops.

When one considers the variety of agricultural assets owned, the ownership is biased towards the hoes. The hoe is the agricultural asset that accounts for the high ownership mean (mean number owned is 3.2) and owned by all irrigators. The hoe is an important tool used by households for field clearing, planting seed, and weeding. The few households that cannot afford to hire tractors for tillage rely on hoes for cultivation.

Table 11 further categorizes agricultural assets to show the distribution of ownership. The majority (40.6%) of households own 4 to 7 agricultural assets. This is followed 29.8% of households that own 8 or more agricultural assets. These figures reveal that that the majority of households at the irrigation scheme are dedicated farmers with the necessary equipment. It also shows the importance of agriculture to the irrigators as a livelihood source. This is further shown in the table by the 60.6% of households owning 1 or 2 sprayers, as well as the hoe-ownership categories. The knap sack sprayers are useful for applying herbicides and pesticides to farmers' crops to control weeds and pests.

Table 11: Agricultural asset ownership by New Forest households (n=94)

Ownership of agricultural assets (tools and equipment such as hoes, spades, sprayers)	1-3 assets = 9.6% of households 4-7 assets = 40.6% 8 or more assets = 29.8% Mean = 6.6 Median =6 Range = 1-17
Ownership of knapsack sprayers	1 or 2 sprayers owned by 60.6% of households
Ownership of hoes	1-3 hoes = 59.6% 4-7 hoes = 39.3% 8 or more hoes = 1.1% Mean = 3.2, Median = 3, Range = 1-9

Table 12 shows the correlation data of the agricultural assets to the farming characteristics. Though the correlations are low (less than 0.5), they are all positive and statistically significant (i.e. $p < 0.05$). There is for example a positive correlation between the number of times the farmers planted this year (2013) and last year (2012) to asset ownership, especially agricultural assets. This implies that asset ownership could be related to the number of times a household plants in a particular year. This is not surprising given the importance of agricultural assets in farm production.

Similarly, there is a positive correlation between total irrigation plot size available (this includes owned and/or rented) and the number of assets owned. This correlation is slightly higher for agricultural assets and in particular sprayers and hoes. The relationship between agricultural assets and land size cultivated is important as larger land sizes can be made productive depending on the assets that one has. Most of the agricultural activities are labour-intensive thus requiring adequate assets (hoes and sprayers) to perform these tasks whether using household and/or hired labour.

Table 12: Correlations between demographics and levels of asset ownership at New Forest (n=94)

	Pearson's r	Significance (p)
Total irrigation plot size available and number of sprayers or hoes (n= 89)	0.28	0.01
Total irrigation plot size available and total number of assets (n=89)	0.26	0.01
Total irrigation plot size available and total number of agricultural assets (n=89)	0.27	0.01
Number of times planted last year (2012) and total irrigation size available (n=88)	0.26	0.02
Number of times planted last year (2012) and number times planted irrigation this year (2013) (n=93)	0.23	0.02
Number of times planted last year (2012) and number of hoes (n=94)	0.3	0.00
Number of times planted this year (2013) and total number of assets (94)	0.34	0.00
Number of times planted this year (2013) and number of agricultural assets (n=94)	0.33	0.00

3.6 Livestock ownership

Few New Forest irrigation farmers own livestock. This is related to the history of displacement and resettlement in the irrigation scheme, as grazing areas are limited compared to their previous residency. Figure 5 below shows the proportion of farmers owning the main livestock types that include cattle, goats, pigs and chicken.

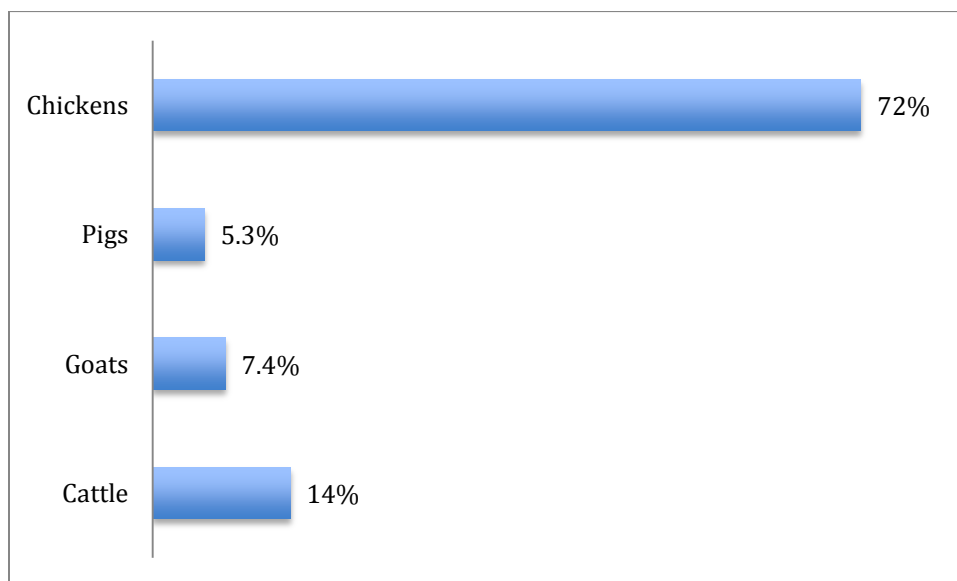


Figure 5: Percentages of New Forest irrigator households owning different livestock (n=94)

Though cattle have various uses, they are the only drought animals owned by 14% of the households. Even fewer households own goats and pigs reared for meat. The majority of households (72%) own chicken mostly for household consumption. The chickens are mostly reared by the women and do not require large spaces to keep, or a lot of food compared to the other livestock types, and have high reproduction rates. These could be the reasons for their high ownership.

Table 13: Number of each livestock type owned by New Forest farmers

Ownership of cattle (n=13)	Mean no.owned – owning hh = 7.7; median = 4.5; range = 1-18
Ownership of goats (n= 7)	Mean no.owned – owning hh = 4.1; median = 4.5; range = 1-18
Ownership of pigs (n= 5)	Mean no.owned – owning hh = 4.6; median = 4; range = 3-7
Ownership of chickens (n= 68)	Mean no.owned – owning hh = 12.6; median = 10; range = 2-50

From the households owning cattle, the households own 7.7 on average as shown in Table 13 above. This provides an adequate number of cattle for drought power though this will be limited to the few farmers owning cattle. The average number of goats and pigs owned is not different and so is the number of households owning these livestock. The average number of chicken owned is very high and could be higher than what is reported as some of the men interviewed provided guestimates citing that their wives would know the actual numbers better.

3.7 Income sources

The income sources of New Forest irrigation farmers are varied and include irrigation income, social grants (pensions, and child grants), formal jobs and piece jobs. The distribution of income sources across households is shown in Figure 6 below. Almost all households (95.7%) derive some of their income from irrigation farming. This demonstrates the importance of irrigation farming in contributing to household's livelihood. Though this does not imply that income from irrigation is always positive, it shows that most households are engaged in irrigation activities to obtain an income.

Just over half of the households are getting the government pension income on a monthly basis. The high proportion of household members that have reached a pensionable age accounts for this. Child grants are also important to New Forest irrigation households as they are received by 40% of the households. Very few households in the irrigation scheme earn income from formal jobs and piece jobs. Formal employment thus does not play a significant role in the lives of the majority of households in New Forest.

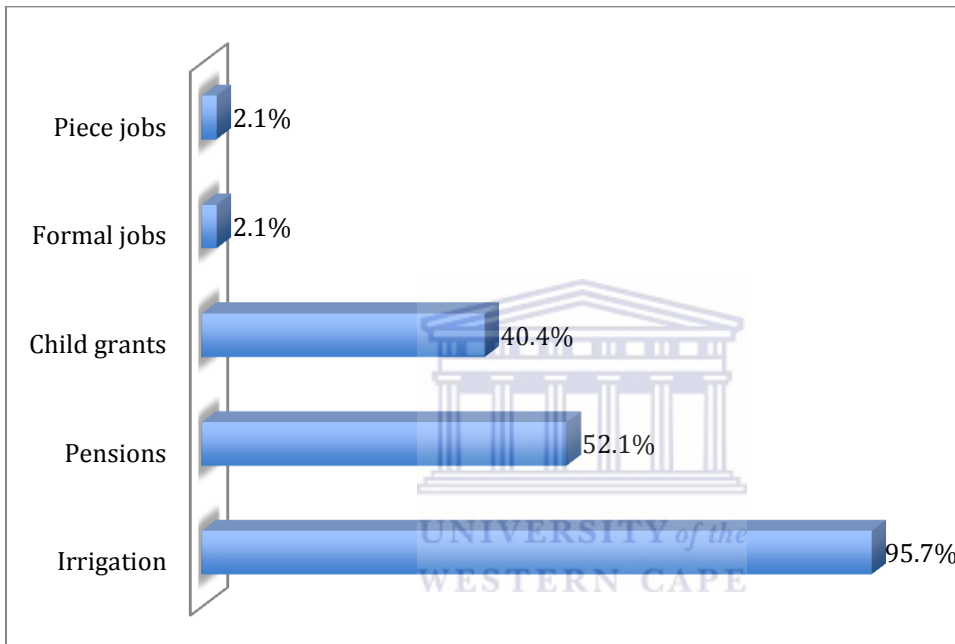


Figure 6: Income sources of New Forest irrigation households (n=94)

The majority of farmers (96% of cases interviewed) cited that they irrigate their fields for the purposes getting an income. The downside of irrigation income is that it is very risky for the irrigators due to water shortages, and lack of a guaranteed market as farmers look for markets as individuals after they have harvested their crops. Besides the government-based pilot vegetable purchasing program (for the schools), farmers look for markets on their own; while some hope that buyers will come to purchase their produce once it is ready for sale. The other factors that have a negative impact on the incomes that farmers receive include high costs of inputs, tillage services and labour.

Social grants constitute another important income source for the New Forest Irrigation

farmers. These social grants are in the form of old age pensions, and childcare grants. South African men are eligible for pensions after the age of 65, while it is pegged at 60 years for women.

The safety-net care for children has been widened by the government through the child support, care dependency and foster care grants. Women who are not employed and have children are eligible for receiving child support grants on behalf of their children. The care dependency grant is payable to children under the age of 18 years, in permanent home care and suffering from severe mental or physical disability. The foster care grant is provided when a court with relevant jurisdiction is satisfied that a child needs foster care. The child is placed in the custody of a suitable foster parent under the supervision of a social worker (Pauw and Mncube 2007:19).

Pensions are quite high (R1200 per month) while child grants are small (R250 per child per month). The data from the 2011 population census shows that compared to all social grants, childcare grants and pensions constitute the largest in Bushbuckridge local municipality. This is shown in Table 14 below. The only social grants mentioned by New Forest irrigation farmers are the pension and child support grants.

WESTERN CAPE

Table 14: Social grants received by households in Bushbuckridge local municipality by the number of recipients

Grant Type	Number of recipients
Child support	98,683
Old age	34,069
Disability	11,760
Foster care	3,219
Care dependency	1,659
Grant-in-aid	137
War veteran	0

Source: Adapted from Bushbuckridge (2013:31).

When comparing pensions and income from irrigation, the pensions have the advantage of reliability and consistency, while income from irrigation is variable and in some cases farmers incur losses. The income received from irrigation tends to be a larger lump-sum amount received during the selling season. This income source also serves as a remunerative income for work done compared to social grants given due to status or condition of the recipient. Child grants are ranked as third due to their small size, though

like pensions their advantage is that they are consistently paid out to households. They thus serve as a safety net if income from irrigation farming is not good.

As shown in Figure 7, very few farmers in New Forest Irrigation scheme mentioned that a household member receives income from formal employment. The few that do receive a formal income do appreciate its contribution to the livelihood of the household and also to farming in particular. I was not able to establish any remittances or their contribution to the livelihood of the irrigators from the household interviews. There were isolated and very few cases of farmers mentioning other income generating activities such as welding, poultry production, and buying and selling.

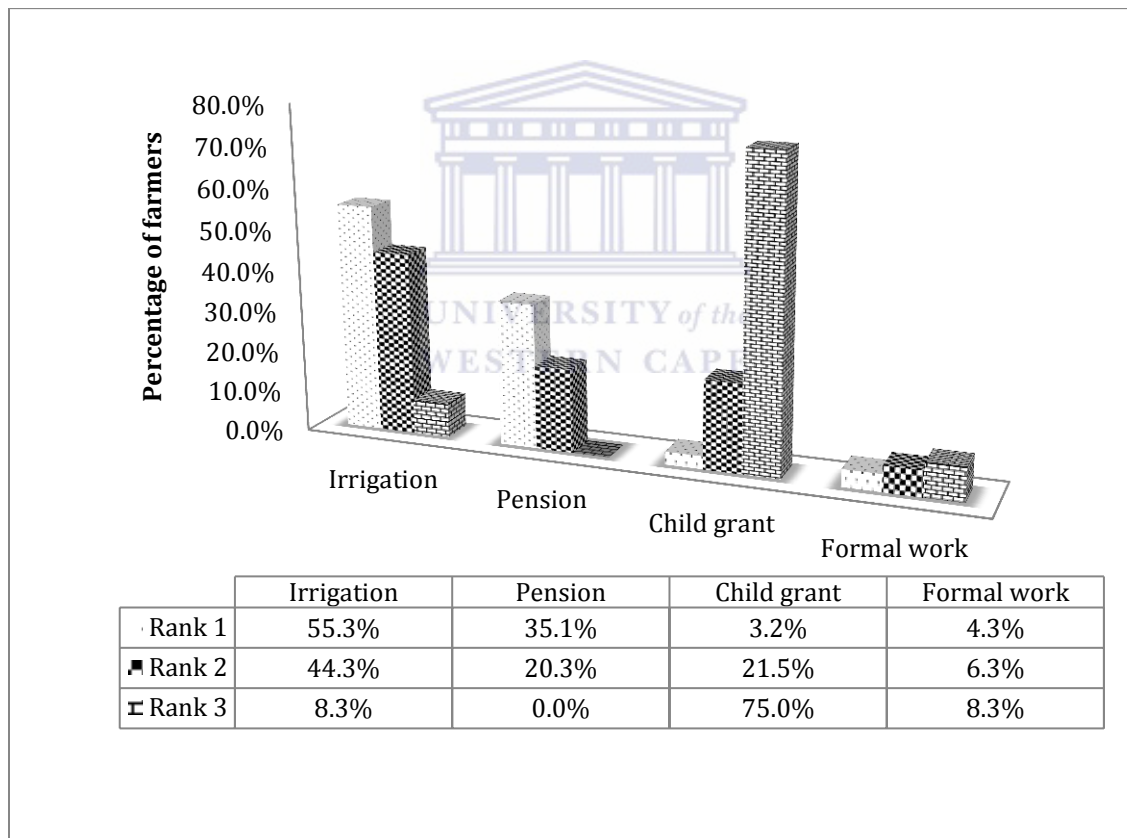


Figure 7: Ranking of income sources in terms of importance to a household (n=94)

The income source ranking shown in Figure 7 above illustrates the importance ascribed to different income. The majority that ranked irrigation income source were those that ranked it under 1 and 2. The Incomes ranked 1 from highest to lowest are irrigation,

pension, formal employment then child grant. A similar pattern is observed for rank 2 except that that child grants are switched with formal employment. Irrigation income clearly stands out as the highest ranked, followed by pensions. The majority of households that ranked child grants are found under rank 3 followed by rank 2. Given the small size of child grants, the few households that ranked child grants as rank 1 obviously have many children, are not receiving pension income and irrigation farming income is insignificant. The proportion ranking formal employment is low across all categories of ranking since few households earn an income from this source.

The reasons for ranking various income sources further sheds light to understanding the contribution of income type to the livelihood of the households. The majority that ranked irrigation income as rank number 1 gave the reason that irrigation provides higher lump sum income compared to the other income sources. Pensions and formal employment were preferred due to the income source being guaranteed (i.e. less risky than irrigation income) and less variable. The child grants were preferred by the households that saw them as the main household income source for family needs. These households are at the lower end of the socio-economic spectrum as child grants are low.

Table 15 further provides information of total number of income sources a household has, as well as the distribution of the social grants income. Though the series of possible income sources available to a household ranges from 1 to 9, the mean and median are low at 2, implying that most households generally have fewer income sources. These fewer income sources as illustrated above are irrigation income and social grants either pensions and/or child grants. The majority of households (36.2%) receiving a pension income rely on a single person from that household. Those households that rely on two people receiving pension income are only 16%. Table 15 also shows that the majority of households receive either one or two child grants.

Table 15: Income sources of New Forest irrigation farming households (n=94)

Total number of sources of income for household	Mean = 2.67; Median =2; Range = 1-9
Number of households receiving old age pensions from state	One or more pensions =52.1% of households One member = 36.2% of households Two members = 16% of households
Number of child support grants received by household members	One or more grants = 40.4% of households One grant = 12.8 % of households 2 grants = 13.8% of households 3 grants = 5.3 % of households 4 or more = 8.6% of households

The correlations (Table 16) on income sources are also positive, statistically significant and some correlations very high (i.e. > 0.5). The positive correlation between household size and child grant amount reveals that children are the main contributors to increase in the household size and these children are also accompanied by child care grants that households receive from the State. The high correlation between child grants and total income types serves to show that the majority of households' income is from child grants. This is inspite of the fact that child grants are the lowest in value.

Table 16: Correlations between demographics, and income sources at new Forest (n=94)

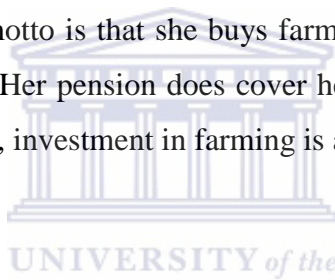
	Pearson's r	Significance (p)
Household size and Child grant amount (n=38)	0.5	0.00
Household size and total number of child grants (n=94)	0.25	0.02
Household size and total income types (n=94)	0.24	0.00
Child grant amount and Number of chickens owned (n=28)	0.38	0.04
Child grant amount and Total number income types (n=38)	0.91	0.00
Total number pensions and total number income types (n=94)	0.23	0.03
Total number of child grants and total number of income types (n=94)	0.89	0.00

3.8 Income uses

The uses of the income that households receive are also varied and include food, education for the children (academic and tertiary), domestic uses (e.g. household construction), and for farm reproduction. The income allocated to farm reproduction caters for activities such as purchase of crop inputs (fertilizer and pesticides), labour hires, and tillage.

From the 11 farmers that provided in-depth information on their lifestyle, Mary and Janet showed that they are the most constrained households in meeting their household and farming needs. Mary prioritizes her income allocation to farming needs ahead of household needs such as food and school fees. School fees are only paid after the needs of farming have been catered for. There are also times when their child goes to school on foot (instead of taxi), as there will not be adequate money. The limited income they have as a household also impacts on the area that they plant their crops and inputs that they access. This in turn results in lower production and lower yields and thus lower income from farming.

Janet on the other hand, prioritizes household and food needs ahead of farming needs. It has never happened in her life that there is not enough food for her household due to the need to purchase inputs. Her motto is that she buys farm inputs when she is certain that there is enough food at home. Her pension does cover her monthly household food bill. As a result of this prioritization, investment in farming is always low and correspondingly the production.



Kenny, Musa and Phineas, are the farmers that have been able to translate their incomes from farming and social grants to invest in the tertiary education of their children. Kenny has invested in his children who are now formally employed in other provinces as teachers and another as a mine engineer. His other child is studying at Vaal University and is funded by Kenny. Musa has educated her elder child in nursing, while she also pays school fees for the other and two orphans that she takes care of. Phineas has also been able to send his eldest child to study electrical engineering at a college in Phalaborwa in addition to his other children still in junior academic education.

3.9 Conclusions

This chapter presented a description of the socio-economic profile of the New Forest irrigation farmers. The introduction to the Bushbuckridge municipality in which New Forest is located, provided the economic and social context of the area relying on data

from the municipality and Statistics South Africa. The data shows differences between some of the New Forest irrigation farmers' information and the local municipality data due to the uniqueness of irrigation scheme households compared to the entire municipality.

The in-depth profile of the 11 irrigation farmers, though not representative of the farmers at New Forest Irrigation scheme, provides a picture of the diversity and similarities ascribed to smallholder farmers. The incomes types received by the irrigators are quite diverse, though irrigation income is the most important followed by social grants that consist of pensions and child-care grants. The uses of the incomes received by New Forest irrigators include food, education of children, domestic uses and farm production. The actual usage of income sources of the households clearly follows the farmers' characteristics.



CHAPTER FOUR: IRRIGATION CROP MANAGEMENT AND PRODUCTION

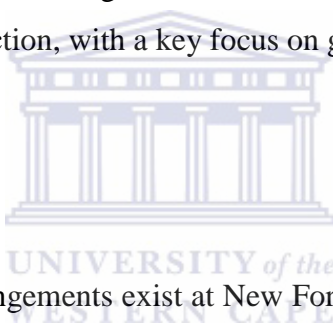
4.1 Introduction

This chapter discusses irrigation crop management and production as practised by New Forest Irrigation farmers. It focuses on the main cash crops (maize, tomatoes, cabbages, sugar beans and spinach) and main subsistence crops (sweet potato, groundnuts, cassava and bambara nuts) that they grew during the 2012/2013 cropping season. Various aspects of the farming systems that are relevant and have an impact on crop production are also discussed, such as land tenure and land size holding, access to inputs, labour regimes, and access to irrigation water and its management. The final section of the chapter explores financial aspects of crop production, with a key focus on gross margin analysis.

4.2 Land tenure

4.2.1 Types of land tenure

Three types of land tenure arrangements exist at New Forest irrigation. The first group of landholders are '*PTO-holders*', who have acquired land either from the government or the chief, or through its inheritance from their parents and/or relatives. They possess permission-to-occupy certificates (PTOs). The second group are '*self-allocated plot holders*'; for them, land adjacent to the existing plots was cleared and converted into an irrigation plot. Falling under this group include existing *PTO-holders* that extended their plots to get more irrigable land, those that did not have access to land at all, and *tenants* that identified adjacent and un-demarcated irrigation land and converted this into an irrigation plot. The self-allocated plot holders are either 'certified' by the chief to use the land or 'uncertified'. The uncertified group uses the plots without any formal approval arrangements from the authorities. The third group, '*tenants*', consists of farmers that do not 'own' land at the scheme but either borrow it for free or rent the land for an annual fee paid to the PTO-holder.



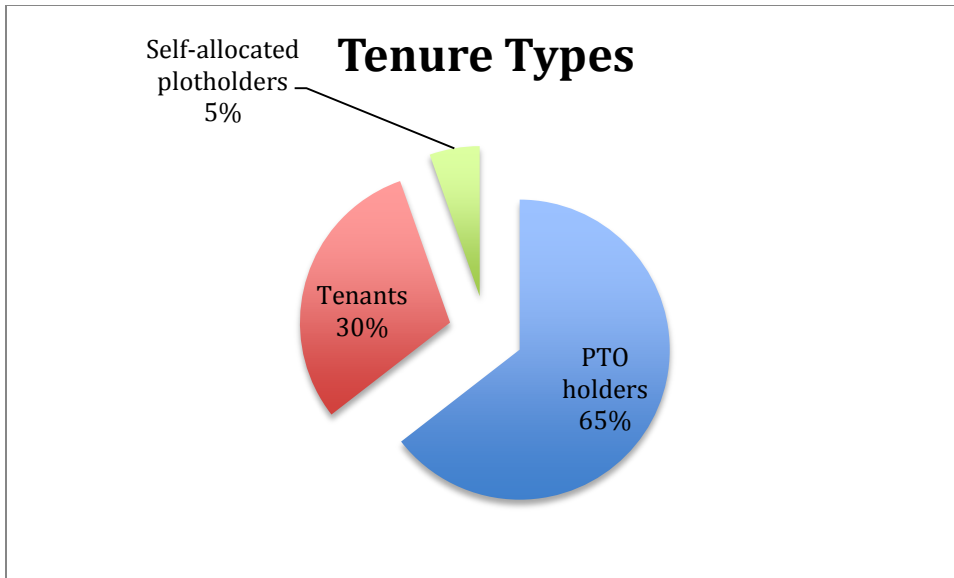


Figure 8: Irrigation plot land tenure types amongst New Forest Irrigators (n=94)

Figure 8 shows the distribution of land tenure types amongst the 94 farmers that were interviewed through the household survey. The PTO-holders (65%) comprise the largest proportion of active irrigators followed by the tenants (30%), while the self-allocated group (5%) is much smaller. The non-land owners group has grown over the years as PTO-holders continue to either lease out their plots (for free or at a fee) or abandon them completely.

Table 17: Land-holding sizes by type of land tenure at New Forest Irrigation Scheme (n= 94)

Type of Plot-holding	Mean land size (ha)	Median land size (ha)	Range land size (ha)
PTO holders n= 61 (65%)	1.33	1.4	0.3-2.8
Tenants n = 28 (30%)	1.05	1.2	0.3-2.4
Self-allocated plot holders n = 5 (5%)	0.93	0.85	0.6-1.4
Anova Results	F (2, 85)= 3.505, p=0.034		

Table 17 compares the three main types of land tenure in terms of size of land available to the New Forest smallholder farmers. Clearly the PTO-holders have the largest land size on average, compared to the tenants and the self-allocated plot-holders. The initial land given to PTO-holders was 1 ha. The reasons for the range of plot sizes for PTO-

holders, many of whom hold less than 1 ha, are mainly to do with sub-divisions of the main plot for sub-letting to others.

An Analysis of Variance (Anova) test to determine whether or not the means for land size are significantly different produced a p value of 0.034, indicating that at least one of the means are significantly different from the others. The table shows that the land size of the PTO-holders is larger than the tenants, and also larger than that of the self-allocated plot-holders. The PTO-holders have the largest areas of land available for farming compared to the other categories of farmers. The tenants are renting/borrowing less land on average than the PTO-holders. This could be a result of sub-letting from the PTO-holders rather than renting out the entire irrigation plot. The self-allocated group have the smallest land size available compared to the PTO-holders and tenants, as this is additional land available that varies greatly in size, depending on whether or not the land adjacent to the scheme is reachable with irrigation water.

Of the 11 farmers interviewed through in-depth life history interviews, the majority (8) were given the land through the PTO system, while Rose and Allan are renting from PTO-holders, and Angela cleared a nearby bush area that could access water from the canals and established her farming enterprise. Angela, coming from Mozambique, initially had applied to the irrigation cooperative to get access to a piece of land for farming, but was not successful. What she then did was to identify a nearby piece of land that could be watered which she cleared and started farming. The extension officers later 'certified' the plot, and Angela now pays R100 per annum as tribal levies to the local chief. Since then Angela has 'secure' title to her land, although she maintains that the land size that she has is insufficient for her farming needs.

From discussions with extension officers, the current irrigation land at New Forest irrigation scheme has expanded far beyond the initial scheme plan. This is due to farmers extending their plot boundaries in order to access more land. This group of farmers includes those that previously were not allocated plots as well as PTO-holders that wanted to increase the size of their plots. The resultant land 'expansion' contributes to

increased pressure on the water supply system. Although irrigable land is under-utilized, the water system cannot irrigate the fields used by the current active farmers at present. This is mainly due to over-silted reservoirs and broken down canals.

4.2.2 Impact of land tenure type and plot size

Allan, Rose and Sam serve as two examples of the large proportion of farmers (30% of my total sample of 94 farmers) that are farming but do not ‘own’ any land in the irrigation scheme (see Table 18). These have the option of either renting or borrowing plots from willing and inactive PTO-holders. This group accounts for the most insecure tenancy at the scheme. Though plots are rented at a cost of R642 per annum on average, with some paying as little as R300 and the highest paying R1000 per year, the tenants face the risk of removal without notice by the PTO-holders.

Allan recalls an instance in which he identified a plot that had not been used for some time and negotiated with the owner, who rented the plot out to him. After he had hired labour, cut down trees and cleared the plot for farming, the owner withdrew the plot from Allan even before planting the first crop. In such a situation the borrower of land has no alternative recourse. Sam’s case is slightly different since he was given the land by his wife’s relatives to use for free, since they were not using the plot. This relationship is based on kinship, rather than commoditization of land, and is probably more secure.

Table 18: Land tenure types amongst 11 New Forest irrigation farmers

Type of Tenure	Names** of Irrigators with access* to the land sizes (n=11)
PTO holding	Derick (1ha) Thabisile (1.2ha) Musa (1.4ha) Mary (1.4ha) Phineas (2.6ha)
Tenant	Sam (1.2ha) Rose (1.2ha) Allan (1ha)
Self-allocated	Janet (1.3ha) Angela (<1ha)

*Access includes land owned as well as that which was borrowed and acquired through renting.

**Kenny was excluded from this analysis as he did not know the size of his landholding.

The estimated land area that is being utilized by farmers at the moment at New Forest, based on my transect walk of the scheme, is less than one third of the entire scheme. This estimate corresponds to the numbers of farmers that the extension officers claim are currently active farmers (150-175). In spite of this low degree of usage, none of the PTO-holders is willing to lease their fields for long periods of time (i.e. more than 2 years). Most lease out their land without defining the time frame so that they can recall it any time. Neither the irrigation cooperative nor the chief interferes or encourages renting out plots or enforces the lease arrangements. This is left to individual PTO-holders.

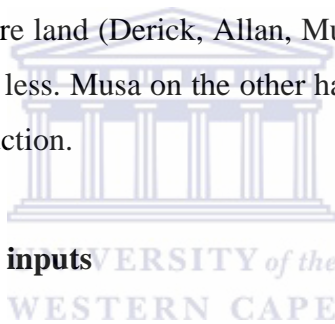
Secure access to land by an irrigation farmer is critically important, as this influences investment and thus production, holding other things constant. The PTO-holders are the most tenure-secure farmers, as they hold documentation as evidence of their rights or have inherited the land from a relative. The self-allocated category experiences a lower level of tenure security, especially those such as Angela whose land has been '*certified*' by the local traditional authority and who pay tribal levies for it. The only threat faced by this group is inadequate water supply due to excessive pressure on the irrigation scheme caused by 'unplanned irrigation extension' by some farmers. Realistically, this group does not contribute significantly to such excessive pressure, given their small numbers (only 5% of the total) and the fact that about two thirds of the scheme is underutilized.

The tenants experience the most insecure form of land tenure. As long as farmers are insecure on the land that they have, they are less likely to invest significantly in agricultural production and maintenance (Adams *et al* 1999: 7). One farmer, Allan, contends that when he applies kraal manure he is never sure that he is applying it to benefit his own crops, given the risk that the owner could remove him before the next planting cycle.

Another critical issue related to tenure arrangements is the size of landholdings available to a household. Derick, Allan, Musa and Thabisile all claim that the major constraint on increased production is inadequate land size. These farmers are not constrained by input

costs, but the land size available to them. Derick's future plans are to purchase an engine for watering a second plot, that is outside the irrigation scheme but near to a river. This dry-land plot is currently not being used by him, although he has access to it. Although Thabisile is happy with her farming income, she would like to increase her plot size from 1.2 ha to 8 ha. She would like to allocate more land to cash crops such as tomatoes, butternuts, cabbages, and onions. Musa also argues that with an increase of her plot size from 2 ha to 4 ha, she could allocate each main crop (maize, butternut, cabbage, and tomatoes) one hectare and thus be able to make significant income from farming. Of the 11 farmers, seven claim that the most successful years of farming were during the past when they allocated large land sizes to a particular cash crop (e.g. green maize, tomatoes or cabbages). This could be related to economies of scale.

From the farmers that want more land (Derick, Allan, Musa and Thabisile), all but Musa have plot-holdings of 1.2 ha or less. Musa on the other hand, although she holds a 1.4 ha plot, wants to expand her production.



4.3 Access to crop production inputs

4.3.1 Sources of crop inputs

The inputs that New Forest irrigators require for their farming include seeds/ seedlings, fertilizers and pesticides. Crop inputs are not locally available in the nearest shopping mall in Thulamahashi Township. From the brief discussion that I had with the manager of Cash Build hardware franchise (the only hardware store in the mall) he advised that as a franchise they generally do not stock farm inputs and thus it would be difficult to stock them even if a demand for them exists. The other shops at Thulamahashi Township include supermarkets, clothes stores, food outlets and Chinese shops that also do not stock farm inputs.

The only sources of farm inputs for New Forest irrigators are located in Nelspruit, Bushbuckridge, and White River, which are each not less than 30 km away. Farmers

purchase their inputs individually and transport them through hiring 'bakkie' traders or through using public transportation like buses and taxis. The costs of transportation of farm inputs are quite high for the farmers; two (Derick and Phineas) said that they can pay 'bakkie' traders up to R400 for a single trip. Sam, in an effort to reduce the costs of transportation of inputs from afar, often teams up with other farmers to jointly hire 'bakkie' owners to transport their inputs. Only some of the farmers in my sample own vehicles (30% of the total), implying that public transportation and vehicle hire are possibly the main modes of transporting inputs.

4.3.2 Access to and costs of crop inputs

The costs of the inputs was cited as very high by my key informant Angela, who feels that input producers and sellers are benefiting more than farmers who buy from them and are not able to recover their money after production and sales. One long term solution that has been suggested by all the 11 farmers interviewed is that the cooperative should purchase inputs in bulk on behalf of the farmers, and stock them locally for farmers to purchase. This would obviously require some loan or credit facility and a degree of 'standardization', or agreement on what farmers will grow at any given time. The cooperative members informed me that they have not yet been able to develop a large enough funding base to enable them to stock farm inputs in bulk on behalf of the irrigation farmers.

In in-depth interviews I was able to establish that the type of crops that farmers choose to grow may either fail or succeed depending on the ability of a farmer to meet the input requirements. Kenny, for example, feels that tomatoes are a very risky crop as they require large amounts of expensive inputs (fertilizer and pesticides), and also tend to ripen at the same time. If the market is not guaranteed at the time of harvest he often experiences large losses from tomatoes.

Thabisile did not have adequate financial resources when she first began to engage in irrigation farming. She grew crops that do not require large amounts of inputs (fertilizers

and pesticides in particular) such as pumpkin leaves and sweet potatoes. The cost of the seeds of these crops is also low compared to tomatoes, onions and maize. They also have short maturity periods and thus provided her with a quick income. She was then able to graduate into other, more input-intensive crops as she acquired the experience, information and resources necessary for growing these.

None the farmers interviewed receive inputs for free but use their own resources, derived mostly from social grants, as well as income from farming, to purchase farm inputs. The free provision of inputs to farmers in the past (in the 2007/2008 season) via the irrigation cooperative was very selective and insufficient, and farmers mentioned that the fertilizers and seeds provided for free were not preferred by the farmers. The fertilizer, for example, was of low nitrogen content, while the seed was low-yielding open-pollinated maize and Bambara nut varieties. This clearly shows that farmers are not consulted when inputs are provided freely to them by government.

4.4 Access to labour

Smallholder farmers rely mostly on labour (household and hired) for their farming activities, given the high cost of mechanization. None of the farmers interviewed owns a tractor. Tractors are hired for ploughing, disking and ridging operations. Farm labour is hired either on a casual or full-time basis. Labour hired on a casual basis serves to assist farmers during the critical, labour-intensive stages of the farming cycle such as land clearing, irrigation, weeding, and pest and disease control. Full-time labourers not only assist the irrigators in their plots, but also in off-farm activities such as cooking and cleaning at the homestead.

Table 19 shows labour usage cash crops, comparing those crops that rely exclusively on household labour and those that involve the hiring of additional labour. Household labour usage across the crops is generally similar, with a mean of 2 to 2.7 household members per crop, except for cabbages whose mean is slightly less at 1.5 household members. The proportion of households hiring labour is highest for tomato and cabbage crops, while

more households rely on household labour for maize, spinach (Swiss chard) and sugar beans. Also, for tomatoes and cabbages, there are a larger percentage of households (28% to 38%) that do not use any household labour but completely rely on hired labour. These crops require a lot of attention in the form of irrigation, fertilizer and pesticide application, and weed control.

Table 19: A comparison of household labour and hired labour usage for cash crops

Crop	Household labour usage	Proportion relying on household labour	Proportion hiring labour
Maize (n=88)	Mean=2.3 (median=2) 0 = 3.4%; 1-3 = 80%; 4 or more = 17%	51.1%	48.9%
Tomato (n=21)	Mean = 2.2 (median=2) 0 = 28.6% ; 1-3 = 47.6% 4 or more = 23.8%	47.6%	52.4%
Cabbage (n=13)	Mean = 1.5 (median=1) 0 = 38.5% ; 1-3 = 46.1% 4 or more = 15.4%	30.8%	69.2%
Swiss chard (n=15)	Mean = 2 (median=2) 0=13.3 %; 1-3 = 80% 4 or more = 6.7%	60%	40%
Sugar beans (n=15)	Mean = 2.7 (median = 2) 0= 0%; 1-3 = 73.3% 4 or more = 26.7%	86.7%	13.3%

Table 20 shows labour usage for subsistence crops, comparing those that rely on household labour and those that involve the hiring of additional labour. Household labour usage across the crops is highest for groundnuts and bambara nuts (a median of 2) compared to sweet potatoes and cassava (a median of 1). This could be explained by the former being more laborious when it comes to weeding and harvesting, while sweet potatoes already have a high proportion of farmers hiring additional labour (45.5% of farmers). The proportions of households that rely exclusively on household labour are more than those that hire additional labour, for all subsistence crops.

Table 20: A comparison of household labour and hired labour usage for subsistence crops

Crop	Household labour usage	Proportion relying on household labour	Proportion hiring labour
Groundnuts (n=35)	Mean=1.8 (median=2) 0 = 5.7%; 1-3 = 85.7%; 4 or more = 8.6%	74.3%	25.7%
Sweet potatoes (n=11)	Mean = 2 (median=1) 0 = 0%; 1-3 = 81.8% 4 or more = 18.2%	54.5%	45.5%
Cassava (n=13)	Mean = 1.3 (median=1) 0 = 7.7%; 1-3 = 92.3%	84.6%	15.4%
Bambara nuts (n=11)	Mean = 1.7 (median=2) 0=9.1%; 1-3= 81% 4 or more = 9.9	81.8%	18.2%

Payments for labour are based on whether the hired person is full-time or casual. The full-time employees are paid R1000 per month on average. The rate for full-time employees is more variable across households as it is based on negotiations between the employer and employee. The rate for casuals is almost the same across the farmers, suggesting that the rate for casual labour is fixed for the area. The casuals are paid about R150 per block of land (0.1ha) regardless of the type of work done. This rate for the casuals is also not dependent on the number of workers. This implies that if 4 workers are hired for weeding two blocks, they will share the R300 after the work is completed, while if one person weeds two blocks he will also be paid R300.

Generally, more New Forest farmers hired casual workers (84% of farmers) compared to those hiring full-time workers (16% of farmers). This could imply that farmers rely mostly on their household labour and only hire during labour-intensive stages of the cropping cycle. This could also imply that full time labour costs are high in the area and so engaging someone full-time must be worth the cost. From the households that hired full-time labour, the hired labourers usually multi-tasked across all irrigation scheme activities, including care of livestock if available, dry-land farming, and other forms of off-farm activities.

Kenny offered me a comparative analysis of local labour versus foreign labour (mostly from Mozambique). The labourers from Mozambique are cheaper than South Africans.

Kenny attributes this to the fact that the South Africans have other income sources such as social grants to fall back on and would thus demand higher wages, while the Mozambican nationals are desperate for any amount of pay. As some of these foreign nationals may not have proper immigration documentation, they are vulnerable to being short-changed. This concurs with findings by Tapela (2008: 194) who found that South African women with access to child grants were not as vulnerable to exploitative wages as immigrants from Zimbabwe and Mozambique. It appears that the irrigators do take advantage of this issue to their benefit, although others that were interviewed did not mention this.

4.5 Water management

4.5.1 History of water access at the irrigation scheme

The access to water at the irrigation scheme has evolved when compared to the past. When farmers were first settled in the scheme the supply of water was adequate for all plot holders. There was a mechanism in place for determining which farmer groups would gain access to water for which particular periods. Farmers thus accessed water for their crops when it was needed. The irrigation fields were not yet extended beyond the size made provision for in the irrigation water system design. Also, in the past the canals were without cracks. The government of the day used to provide maintenance works to ensure that the canals and reservoirs were in a condition to channel water for irrigation without wastage.

The reservoirs and valves were also well maintained with minimal water leakages. According to one woman farmer interviewed, Janet, the scheme had ‘police watchdogs’ that inspected the canal and ensured that water was accessed fairly by plot holders from the different irrigation sections. They also were able to advise authorities about repairs that were required.

4.5.2 Current status of water access at the irrigation scheme

The New Forest Irrigation Scheme is divided into four irrigation wards, New Forest, Tsuvulani, Demulani and Edinburgh. No section has access to adequate water at present, but sub-sections within the irrigation sections differ in terms of their access to adequate water. The plots that are near to the reservoirs and have solid canals tend to be able to access more water than others. Farmers are in conflict over water, as there is no organised system of water allocation. Though farmers were allocated days for watering their respective fields, none now follows the schedule and there are no enforcement mechanisms in place. Water is accessed on a first come-first served basis. The first farmer to arrive on a given day opens the gate valve and waters his/her plot, while the latecomers do not access adequate water for their needs. This also depends largely on the location of individual farmer plots. The plots located furthest to the reservoirs tend to get less water than those located closest to them.

According to the irrigators, the dam and reservoirs have been silted up which reduces their water holding capacity and thus constrains their access to sufficient water. The reservoirs/storage dams are not kept tidy and are littered with waste in the form of papers, plastic, trees and other vegetation. Since 1994 the current government has not made any efforts to repair the main canals and sub-canals that have broken down. This leads to extensive water losses and the inability to transport water to most of the farmers' fields. The local municipality claims that New Forest irrigation canal networks have not received any maintenance over the last 30 years, and canal leakages can account for over 40% of lost production potential (BLM 2010: 47).

The people that de-bush the land close to the scheme so as to access water for irrigation purposes make further demands on the water. Some of these people have been retrenched from the mines and factories and so see the irrigation scheme as a livelihood opportunity.

Of the 11 farmers providing in-depth life history interviews, only Derick mentioned that he did not face any water challenges. The rest said that access to sufficient water at the

scheme was a challenge. Angela revealed that she sometimes has to forego attending church services on Sunday so that she can water her fields, as during the week the demand for water is high making it difficult for her to access sufficient water. She believes that the majority of farmers that have stopped farming at the irrigation scheme have been discouraged by the low volumes of water available. Similarly, Mary said that the canal bringing water to her fields is broken down. There are times when a full week goes by without access to any water for her crops.

4.5.3 Impact of water challenges at the scheme

The impacts of water shortages at New Forest irrigation scheme are negative. If a farmer does not receive adequate water when a crop needs it, physiological growth of the crop will be impeded. Crops have particular periods with minimum water requirements or they fail to thrive. There are periods when farmers obtain lower yields or even lose an entire crop. Some farmers like Janet resort to planting less land, as they are not sure if they will obtain enough water for their entire plots.

Conflict between farmers has also been prevalent as a consequence of their efforts to obtain adequate water for irrigation. The farmers interviewed through in-depth life histories revealed that water conflicts are widespread. Water conflicts are usually resolved at village committee level within each village. When farmers fail to resolve disputes at the lower level, this is escalated to the irrigation scheme cooperative level.

The water shortage also accounts for the low rates of utilization of land within the irrigation scheme by the majority of PTO-holders, with evidence of widespread abandonment of plots. A cross-sectional walk across the scheme revealed that there is more land not being utilized compared to land that is being cultivated.

Without assistance from outside, farmers have taken temporary initiatives to ensure that water is able to reach their fields. Some farmers resort to patching the cracks on their canals using mud and sand bags. This is very rudimentary and cannot address the root



Figure 9: Feeder canal drawing water from a reservoir to farmers' fields at New Forest irrigation

Figure 10: One of the broken canals channeling water to the farmers' fields



Figure 11: One of the reservoirs storing water for the irrigators

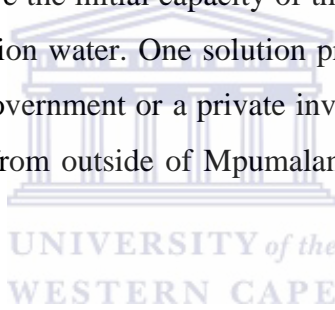


Figure 12: Reservoir that has been silted and overgrown with grass and shrubs



causes of insufficient water. Allan, who is renting land for irrigation, developed his own plan of ensuring that water is available in his plots. When he was offered the land that he is currently using, water could not reach his fields. He had to investigate and determine the cause of water blockages, clear the canals, and construct earthen canals to channel water to his fields. Now water is able to reach most of his fields (although not those on higher ground). He is still investigating how water can reach the high lying land.

The irrigation committee feels that main canal and sub-canals have to be rehabilitated, while the main dam and the reservoirs need to be scooped, and the broken valve in the reservoir should be replaced. The extension officers contend that repairs alone to the irrigation scheme would not solve the water supply problem, as the total area under irrigation is now over and above the initial capacity of the scheme, due to increased land sizes by those requiring irrigation water. One solution proposed by Thabisile is that the scheme should approach the government or a private investor for a loan, and then hire a private contractor, preferably from outside of Mpumalanga Province, to rehabilitate the canals and the reservoirs.



4.6 Crops grown by New Forest irrigators

New Forest irrigation farmers grow a diverse range of crops that include cash crops and subsistence crops. Figures 9 and 10 show the pictures of maize and sweet potatoes from a farmer's field at the scheme. For the purposes of this study, cash crops are crops that the New forest farmers grow primarily for sale, while subsistence crops are grown essentially for household consumption. Out of the top nine major crops grown, five are cash crops, while four are subsistence crops. Farmers grew three crops each on average during the 2012/2013 cropping year, while the range varies between a single to six crops grown by an individual farmer.

The cash crops include green maize, tomatoes, spinach (Swiss chard), cabbage, and sugar beans. The subsistence crops include groundnuts, cassava, sweet potato and bambara groundnuts. The cash crops are mostly perishable (besides sugar beans) while subsistence

crops are non-perishable. As most of the marketing is done locally (see Chapter 5 for more details), some farmers sell some of the subsistence crops as well, while the households also consume some of the cash crops.



Field of sweet potato and yams in the background.

Figure 13: Famer’s sweet potato field at New Forest Irrigation scheme



Fallow field with maize in the background.



Figure 14: Farmer's maize field at New Forest irrigation scheme

4.6.1 Cash crops and subsistence crops

Figure 15 shows the major crops grown by the New Forest irrigation farmers as well as the proportion of total area planted to the crops. Maize is the dominant crop grown by the majority of farmers (93%). The majority of maize growers sell the crop as green mealies to ‘bakkie’ traders, and hawkers. Maize also commands the largest land size allocation (62% of the area controlled by individual farmers) compared to other crops. These figures show the importance of the maize cash crop to the New Forest irrigators.

In addition to maize, groundnuts are the other main crop, grown by 37% of the households and allocated about 27% of the land area of individual farmers on average. Interestingly groundnuts are grown mostly for subsistence purposes, with very small quantities for sale to neighbours.

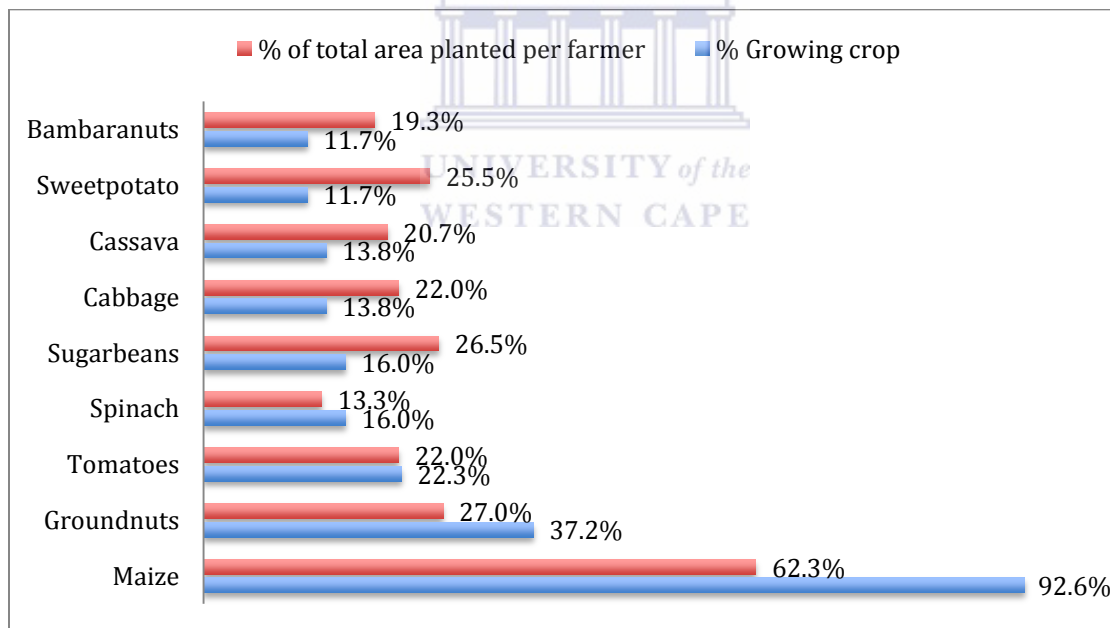


Figure 15: Profile of crop production at the New Forest Irrigation scheme Bushbuckridge, Mpumalanga Province

Figure 16 shows the relative importance of major vegetable types in terms of gross value of production produced nationally in South Africa during the 2012/13-production year. In this case, I use gross value of production as a proxy measure of importance and demand.

When comparing these data with the New Forest data, the most common crops at both levels are green maize, tomatoes and cabbages. At national level, these account for 64% of combined gross value of production.

At the irrigation scheme level, these three crops have been also accorded great importance as the majority of farmers are growing green mealies, tomatoes and cabbage and have allocated large proportions of their total land area to them. Although onions are a significant crop in terms of their value of production at national level, this is not so at New Forest Irrigation Scheme. The national data also show carrots, pumpkins and squash as important crops, but these did not feature prominently amongst the New Forest irrigators. In my sample, (n = 93) only 7 farmers grew pumpkins, one grew carrots, and none grew squashes.

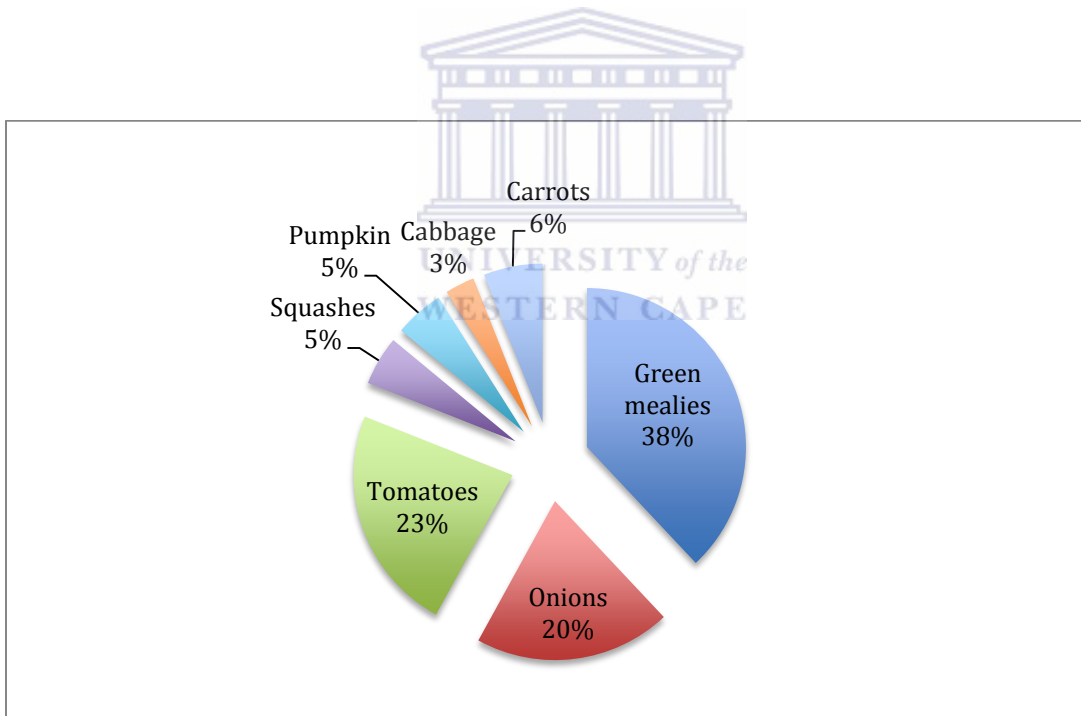


Figure 16: Relative importance of major vegetables in terms of production value in South Africa during 2012/13 season. Source: DAFF 2014: 49

Table 21 shows the seed planting rates per ha for some of the crops grown by New Forest irrigators. The planting rates for maize, cabbages, sugar beans and bambara nuts on

average fall well below those recommended by the Department of Agriculture, Forestry and Fisheries (DAFF) for commercial production.

A T-test one sample mean comparison between these rates shows significant differences at a 95% confidence level. This means that for the crops with $p < 0.05$, there are statistically significant differences in seed planting rates between those undertaken by New Forest irrigators and DAFF recommendations. Low planting rates for these crops by New Forest irrigators have a negative impact on the potential crop yield, due to low plant populations (Mnkeni *et al* 2010: 41). Only tomatoes, groundnuts and spinach are within the recommended commercial planting rates. It was difficult to ascertain the cropping rates for other crops (i.e. sweet potato, cassava), as farmers did not use uniform measures that could be converted into the same unit measure.

Table 21: Crop planting rates for crops grown at New Forest irrigation scheme, compared to the DAFF guidelines

Crop (proportion growing crop)	New Forest seed planting rates per ha	DAFF ⁶ planting rates per ha guidelines	T-test
Maize (92.6%)	Mean= 13.96kg/ha Median=10kg/ha Range- 2.12-80 kg/ha	25kg/ha	t=-8.794, df=82, p<0.000
Tomato (22.3%)	Mean=15,820 seedlings/ha Median=10,300 seedlings /ha Range- 2,000-80,000/ha	15,000 seedlings/ha	T=0.169, df=14 p=0.869
Cabbage (13,8%)	Mean= 10,902 seedlings/ha Median=10,000 seedlings/ha Range- 4,500-16,667 seedlings/ha	35,000 seedlings/ha	t=-22.74, df=10 p<0.000
Swiss chard (16%)	Mean=18.18kg/ha Median=10kg/ha Range- 2.5-60 kg/ha	8kg/ha	t=1.78, df=10 p=0.11
Sugar beans (16%)	Mean= 62kg/ha Median=50kg/ha Range- 20-100 kg/ha	90kg/ha	t=-3.26, df=14 p<0.01
Groundnuts (37.2%)	Mean=60.34kg/ha Median=50kg/ha Range- 17-200 kg/ha	50kg/ha	t=1.33, df=28 p=0.2
Bambara nuts (11.7%)	Mean=51kg/ha Median=40kg/ha Range-10-100kg/ha	25-75kg/ha*	t=2.85, df=10 p=0.02

*Source: Swanevelder CJ (1998).

⁶ Source: Whitehead ENC, Archer CG (2011). COMBUD Crop budgets. Field crops. 2011/2012.

The low planting rates for maize, cabbage, sugar beans and bambara nuts might be explained by the high cost of seed, as well as lack of knowledge. The cost comparisons discussed in the section below on gross margin analysis show that seed costs are either the second or third highest after fertilizers and tillage hire.

Maize is the most important grain crop in South Africa and the staple food of the majority of South Africans (DAFF 2014: 9). A DAFF 2014 report showed that for the 2012/13 season, maize production in Mpumalanga province was the second most prevalent crop per province in the country at 26% of the total area under crops, after the Free State Province. Non-commercial farmers growing maize are mostly from Mpumalanga, Eastern Cape, Limpopo and KwaZulu-Natal provinces, and account for 5% of national maize production. At national level this maize is utilized as grain, while at New Forest most of the maize produced is sold as green mealies. The planting of maize by the irrigators occurs throughout the year, since maize under irrigation is an all-year-round crop.

At national level, Limpopo province accounts for more than 75% of the total area planted to tomatoes, followed by Mpumalanga and Eastern Cape (DAFF 2012c: 3). DAFF (2012c: 4) claims that there are approximately 695 tomato producers in the commercial and emerging sectors, of which the former contributes 95% of the production.

Irrigation farmers plant tomatoes using either seedlings or seeds, with both methods exhibiting very large planting rates discrepancies. This may be due to lack of knowledge on planting rates, as well as the cost of tomato seeds. Some farmers also use the spoilt tomatoes from other farmers as material for planting the next tomato crop in their fields. Most farmers plant tomatoes in March, June and July, while harvesting takes place between May and October.

Although cabbages are grown in most provinces of South Africa, they are mostly concentrated in Western Cape, KwaZulu-Natal, Eastern Cape, Free State, Gauteng, and

North West provinces (DAFF 2010a: 4). Planting dates range between March and June while harvesting is from June to October.

Swiss chard is produced throughout South Africa for use as a salad and cooked as a relish. Planting is done during the first six months of the year, while harvesting from March through to September.

Groundnut production in South Africa is mostly concentrated in Free State, North West and Northern Cape provinces, with low production in Limpopo and Mpumalanga provinces (DAFF 2010b: 1). In Mpumalanga province, Thulamahashe and Bushbuckridge are noted as groundnut producing areas by DAFF (*ibid*). Most farmers in the New Forest scheme plant groundnuts in September and October, and harvest them from December through to March.

Sugar beans are classified as dry beans in South Africa, and include the small white canning beans and the large white kidney beans. At a national level, Mpumalanga and Free State provinces together recorded the highest production levels of dry beans (51.7% of the total) in the 2012/13 year (DAFF 2014: 34). At the New Forest scheme, sugar beans were planted between July and September, while harvesting was from July to September.

Cassava in South Africa is grown as a secondary crop by smallholder farmers, and by the commercial sector for production of commercial and food grade starch (DAFF 2010c: 1). The main regions cultivating cassava in South Africa are Limpopo, Mpumalanga, and Northern KwaZulu-Natal (*ibid*: 2). Cassava is planted between August and September at New Forest, while harvesting occurs a year later in July and August. It was difficult to ascertain planting rates, as farmers did not count the number of cuttings planted.

The main sweet potato growing regions in South Africa are Northern Cape, Western Cape, Limpopo, Free State, Eastern Cape, and Gauteng provinces (DAFF 2013: 3). The production of sweet potatoes has been fairly unstable over the last 10 years due to

weather conditions and increased production costs (*ibid*). Sweet potatoes are planted in August, November and December and harvested from December to April.

4.6.2 Soil fertility management

Every farmer planting tomatoes, cabbages, and sugar beans applied fertilizers to their crops. The majority of farmers (over 80%) planting maize, sweet potato and Swiss chard also applied fertilizers. This data closely resembles observations by FAO, cited in the Fertilizer Society of South Africa study, in which fertilizers were applied by 95% of farmers to maize, and 100% to vegetables (including tomatoes, cabbages and the leafy vegetables) (FAO 2005: 25). Pesticides, on the other hand, were applied disproportionately across crops with the majority of farmers (over 75%) applying pesticides to cabbages, maize and tomatoes compared to the other crops.

Table 22: Proportion of New Forest irrigation farmers applying fertilizers and pesticides to major crops

Crop ⁷	Proportion applying fertilizer	Proportion applying pesticides
Maize (n=87)	97%	86.2%
Tomato (n=21)	100%	76.2%
Cabbage (n=13)	100%	100%
Sugar beans (n=15)	100%	6.7%
Sweet potato (n=11)	81.8%	0%
Swiss chard (n=15)	93.3%	53.3%
Groundnuts (n=35)	0%	0%
Cassava (n=13)	0%	0%
Bambara nut (n=11)	0%	0%

There are clear differences in crop management practices when cash crops are compared to subsistence crops. A large number of households (if not all the particular crop growers) applied fertilizers and pesticides to the cash crops, while in relation to subsistence crops, fertilizers were applied only to sweet potatoes. For groundnuts, bambara nuts and cassava it is clear that no fertilizers and pesticides were used at all. Smallholder farmers in South Africa generally do not apply inorganic fertilizers to these crops, although DAFF notes

⁷ Farmers were not applying fertilizer and chemicals to groundnuts, bambara nuts and cassava, though these have been classified as ‘major’ crops in my analysis.

that this may be necessary after prolonged depletion and/or when planting improved varieties (DAFF 2010b: 6; DAFF 2010c: 6).

Nutritionally, crops require all the three major essential elements (Nitrogen, Phosphorus, and Potassium, herein referred to as N, P and K) to thrive. The three numbers used to name a fertilizer type (e.g. 2:3:2) describes the proportion of nitrogen, phosphorus, and potassium respectively, available to plants in a fertilizer bag (Grain SA, 2011:6; Maguire *et al*, 2009:2).

Table 23: Types of fertilizers applied to the major crops by New Forest irrigation farmers

Crop	Percentage of farmers applying fertilizer type
Maize (n=87)	LAN – 96.5% 2:3:2 – 82.4% 1:0:1 – 8.2% 2:3:4 – 9.4%
Tomato (n=21)	LAN – 95.2% 2:3:2 – 66.7% 1:0:1 – 14.3% 2:3:4 – 14.3%
Cabbage (n=13)	LAN – 92.3% 2:3:2 – 53.8% 2:3:4 – 46.2% 6:3:4 – 15.4%
Sugar beans (n=15)	LAN – 100% 2:3:2 – 66.7% 3:2:3 – 20%
Swiss chard (n=15)	LAN – 85.7% 2:3:2- 78.6% 2:3:4 – 7.1 % 3:2:3 – 7.1%
Sweet potato (11)	LAN – 55.6% 2:3:2 – 77.8%

The most common fertilizers applied by the majority of farmers across the crops are LAN (limestone ammonium nitrate), and 2:3:2 fertilizers. The number of farmers applying LAN across crops ranges from 100% for sugar beans, to 55.6% for sweet potatoes. The number applying 2:3:2 fertilizer ranges from as high as 82.4% on maize, to 53.8% on cabbages.

These two fertilizers show that the majority of farmers are providing mostly nitrogen, and phosphorus, than potassium. This practice is not based on soil requirements (since no soil tests are ever done), but on other factors such as prior knowledge of a crop's requirements, or advice from others. The lower proportion of farmers applying other fertilizers to their crops also serves to show that most farmers generally apply at least two fertilizer types to particular crops, while few would apply three or four fertilizer types to a crop.

The fertilizer application rates across crops (Table 23) reveal that the highest application of fertilizer per ha is to tomatoes, then cabbages, then maize. The fertilizer application rates for tomatoes are actually almost double the fertilizer application rates for maize. The 2:3:2-type fertilizer has the highest application rates when applied to cabbages, sugar beans, and sweet potatoes, while for tomatoes and spinach, 2:3:4 has the highest application rates. The lowest applications of fertilizers are for sugar beans and sweet potatoes. The application of fertilizers to cash crops rather than to subsistence crops makes sense since farmers expect to recoup the high fertilizer costs from the sales of the cash crops.

Table 24: Fertilizer application rates used by farmers at New Forest irrigation scheme

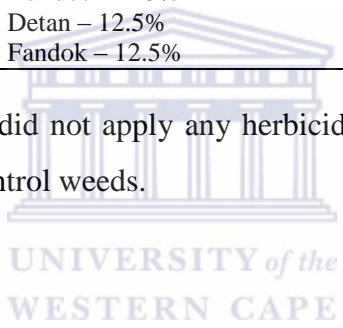
Crop	Fertilizer application rate kilograms per ha (mean)	Fertilizer application rate kilograms per ha (median)
Maize (n=78)	LAN – 360.57kg 2:3:2 – 324kg 1:0:1 – 217kg 2:3:4 – 194kg	LAN – 250kg 2:3:2 – 250kg 1:0:1 – 232kg 2:3:4 – 167kg
Tomato (n=21)	LAN – 733kg 2:3:2 – 604kg 1:0:1 – 833kg 2:3:4 – 1,422kg	LAN – 500kg 2:3:2 – 417kg 1:0:1 – 500kg 2:3:4 – 600kg
Cabbage (n=13)	LAN – 461kg 2:3:2 – 493kg 2:3:4 – 479kg 6:3:4 – 354kg	LAN – 500kg 2:3:2 – 500kg 2:3:4 – 500kg 6:3:4 – 354kg
Sugar beans (n=15)	LAN – 170kg 2:3:2 – 514kg 3:2:3 – 375kg	LAN – 167kg 2:3:2 – 292kg 3:2:3 – 375kg
Swiss chard (n=15)	LAN – 360kg 2:3:2- 439kg 2:3:4 – 500kg 3:2:3 – 500kg	LAN – 250kg 2:3:2- 250kg 2:3:4 – 500kg 3:2:3 – 500kg
Sweet potato (11)	LAN – 175kg 2:3:2 – 202kg	LAN – 200kg 2:3:2 – 200kg

When we observe the data for pesticide application below, it is clear that fewer farmers apply pesticides compared to fertilizers. The most common pesticides applied across cash crops are Bulldock and Celkron, which are broad-spectrum pesticides. Bulldock, Celkron, and blue death are insecticides, while copper liquid and copper powder are fungicides. Tomatoes have the largest number of pesticide types applied (5), followed by cabbages, Swiss chard, and maize. At least three types of pesticides are applied to cash crops, except sugar beans in which only a single pesticide was applied. None of the subsistence crops (groundnuts, cassava, bambara nuts, and sweet potato) received any pesticide application.

Table 25: Types of pesticides applied to the major crops by New Forest irrigation farmers

Crop	Percentage of farmers applying pesticide type
Maize (n=87)	Bulldock – 56.6% Celkron – 10.5% Blue death – 7.9%
Tomato (n=21)	Celkron – 56.3% Bulldock – 31.3% Detan – 18.8% Agtep – 18.8% Copper liquid – 18.8%
Cabbage (n=13)	Bulldock – 38.5% Celkron – 23.1% Agtep – 23.1% Copper powder – 15.4%
Sugar beans (n=15)	Bulldock – 100%
Swiss chard (n=15)	Celkron – 50% Bulldock – 25% Detan – 12.5% Fandok – 12.5%

New Forest irrigation farmers did not apply any herbicides to their crops, but relied on hand cultivation methods to control weeds.



4.7 Gross margin analysis

4.7.1 Input cost comparisons for cash crops

A crop record sheet enabled the capturing of data for all the crops grown in the period of field research by each farmer. The farmers provided information such as seed quantity planted and cost, planting and harvest dates, types and quantities of fertilizers and pesticides applied, and the tillage services used such as ploughing, ridging and disking. Additional information captures included labour usage (household and hired) for various crop production activities, and income received for the crops sold. For the crops that were not sold but harvested, I relied on the farm-gate prices of the respective crops cited by the farmers.

Cash crops were analysed in terms of the contribution of the different types of production costs to total costs. The key production costs include seed/seedling costs, tillage costs

(ploughing, ridging and disking), fertilizer costs, pesticide costs and costs of hired labour allocated to the particular crop. I was not able to establish any marketing costs as the majority of farmers used local marketing channels (hawkers, 'bakkie' traders, and neighbours) to sell their produce. The hawkers, 'bakkie' traders and neighbours purchase the various crops from the farmers' fields. Most of these sales occur at the farmgate level.

Seeds/seedlings, fertilizer and pesticides were purchased in different locations outside of New Forest such as Nelspruit, Bushbuckridge or White River.

The costs paid for labour (permanent) generally varied across farmers for monthly costs, while casual labour rates were the same across farmers, indicating that there was a standard 'informal casual labour rate' in the area. In order to allocate the permanent labour costs across crops for the few farmers that had permanent labour, I apportioned these according to the area of land planted to that crop. This served as a reasonable estimate of labour costs per crop given that irrigation farming was the main enterprise that the households are engaged in. The majority of farmers hired casual labour rather than permanent labour. Interestingly, the casual labour charges were also the same regardless of the activity undertaken, be it for cultivation, planting, or application of fertilizers and pesticides.

Table 26: A comparison of the main production costs for the cash crops grown by New Forest irrigation farmers

Crop	Proportion of seed costs	Proportion of tillage costs	Proportion of fertilizer costs	Proportion of pesticides costs	Proportion of hired labour costs
Maize (n=86)	Mean= 12.2% Median= 11.2%	Mean= 16.6% Median= 16.5%	Mean= 55.2% Median= 55.7%	Mean= 3.8% Median= 2.4%	Mean= 12.2% Median= 0
Tomato (n=21)	Mean= 19.4% Median= 11.2%	Mean= 7.4% Median= 7.9%	Mean= 52.1% Median= 53.6%	Mean= 7.5% Median= 5.9%	Mean= 13.6% Median= 6.7%
Cabbage (n=13)	Mean= 25.4% Median= 21.9%	Mean= 4.7% Median= 5.7%	Mean= 48.3% Median= 48.3%	Mean= 7.5% Median= 4.3%	Mean= 14.1% Median= 15.8%
Swiss chard (n=15)	Mean= 12.5% Median= 7.6%	Mean= 15.9% Median= 10.2%	Mean= 53.7% Median= 57.7%	Mean= 6.1% Median= 5%	Mean= 11%
Sugar beans (n=15)	Mean= 18.5% Median= 14.2%	Mean= 11.5% Median= 12.3%	Mean= 65% Median= 68%	Mean= 0.9% Median= 0	Mean= 3.8% Median= 0

Table 26 shows that the highest costs of production are for fertilizers across all the cash crops. Fertilizers account for between 48% and 65% of all total production costs, and are thus critical in determining the profitability of these cash crops. The highest production costs for maize and spinach are costs of fertilizer and tillage, while for tomatoes and cabbages they are fertilizers and seed costs. The costs of maize and spinach seed contribute the least to production costs compared to tomatoes, cabbages and sugar beans where seeds are more expensive.

4.7.2 Input cost comparisons for subsistence crops

The most significant subsistence crops grown by New Forest irrigation farmers are groundnuts, sweet potato, cassava, and bambara nuts. These crops were also analysed in terms of the contribution of key production costs to total costs. The key production costs include seed/seedling costs, tillage costs (ploughing, ridging and disking), and costs of hired labour allocated to the particular crop. No pesticide costs were incurred on the subsistence crops.

New Forest farmers did not incur costs for fertilizers on groundnuts, cassava and Bambara nuts since they generally do not apply fertilizers on these crops. Fertilizers are thus relevant only in relation to sweet potatoes, and here account for 55% of total costs. Sweet potatoes are the only subsistence crops to which fertilizers are applied. Fertilizers are therefore the highest contributor to the sweet potato production costs. Tillage costs then follow, and labour costs are almost as high as tillage costs. Seed costs for sweet potatoes are very low as farmers that purchase the seedlings use local informal channels.

The highest contributor to production costs for groundnuts and cassava are tillage costs, followed by labour hire. The seed costs for groundnuts take the third place following the labour costs closely, while seed costs for cassava are almost negligible due to retained seedlings and free hand-outs from neighbours.

For the bambara nut crop, the highest production costs are accounted for by the seed costs, followed by the labour costs. The low contribution of tillage costs to total production costs is related to the small area of land allocated to bambara nuts compared to groundnuts, sweet potato and cassava.

Table 27: A comparison of the main production costs across the subsistence crops grown by New Forest irrigation farmers

Crop	Proportion of seed costs	Proportion of tillage costs	Proportion of fertilizer costs	Proportion of pesticides costs	Proportion of hired labour costs
Groundnuts (n=27)	Mean= 18.4% Median= 0	Mean= 58% Median= 68.4%	0	0	Mean= 23.5% Median= 0
Sweet potato (n=10)	Mean= 3.3% Median= 0	Mean= 23.6% Median= 21.7%	Mean= 55% Median= 55%	0	Mean= 18.1% Median= 12.8%
Cassava (n=8)	Mean= 1.4% Median= 0	Mean= 73.6% Median= 100%	0	0	Mean= 25% Median= 0
Bambara nut (n=10)	Mean= 55.4% Median= 64.1%	Mean= 7.2% Median= 0	0	0	Mean= 17.4% Median= 0

4.7.3 Income statements of crop enterprises

4.7.3.1 Positive and negative gross margins

Gross margins were calculated for the major crops grown by New Forest farmers. Gross margins were determined by subtracting crop production costs from the gross income received from the particular crop. In the case of crops that were not sold, but a harvest was obtained, I used the farm-gate price represented by the generally accepted price for that crop in the area. The crop production costs that could be established with certainty were seed costs, tillage costs, fertilizer costs, pesticide costs and hired labour costs.

The total gross margins per farmer per crop were aggregated to determine the overall gross margin per farmer. The gross margins applied to a single planting cycle and on a single bed planted. This allowed the identification of farmers that made an overall positive gross margin and those that made an overall negative gross margin. At New Forest Irrigation Scheme, there are more farmers that made a profit (61.3%) compared to those that made an overall loss (38.7%). This shows that smallholder farmers are able to make profits from smallholder irrigation production. A one-sample binomial test of these proportions shows a borderline significance of $p=0.05$, showing that the proportion of profit and loss makers are not statistically different. There is therefore a 5% chance that this difference is not statistically valid. The profit margins made are R5283.56 on average while the loss is -R2932.46 on average. The range of profits made shows that for some the margins are low (R12), while for others it is quite high (R24, 915). The losses also range from as high as -R8, 265 to a low of -R110.

Table 28: A comparison of total gross margins between profit makers and loss makers

	Proportion	Mean gross margin (Rands)	Median gross margin (Rands)	Range (Rands)
Profit makers	61.3%	5,283.56	3,333	12 to 24,915
Loss makers	38.7%	-2,932.46	-2,655	-110 to -8,265
All farmers	100%	2,080	1,025	-8,265 to 24,915

Table 28 shows the positive gross margins for the main crops grow by the New Forest irrigators. The crops that show the majority of farmers growing maize (green mealies), groundnuts, sweet potato, spinach, bambara nuts, and cassava make a profit from these crops. All these crops except maize and spinach are subsistence crops. The main cost drivers as shown in the previous section are the costs of fertilizers and seeds, while for subsistence crops they are tillage and labour-hire. Although there are more farmers making a profit through production of subsistence crops than through the growing of cash crops, the gross margins of cash crops, as well as their gross margins per hectare, are generally higher.

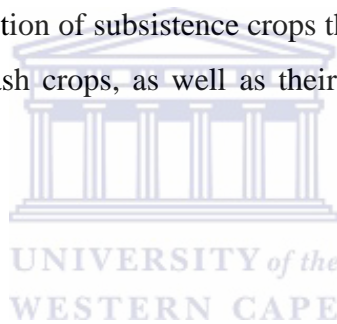


Table 29: Positive gross margins for main crops

Crop	Profit makers as proportion of all growers		Positive gross margin R			Gross Margin R/Ha	
	%	N	Mean	Median	Range	Mean	Median
Maize	56.3	87	2,993.68	2,265	53 - 15680	6,647	2,975
Tomato	46.6	21	3,087.70	1,299.50	119 - 10,975	15,154	9,118
Cabbage	30.8	13	8,190.25	6,440	1,410-18,471	31,155	24,475
Groundnuts	97.1	35	899.32	890	50 - 2,100	5,330	4,025
Sugar beans	33.3	15	434.4	217	40 - 1,260	3,544	1,867
Sweet potato	72.7	11	1,686.38	464.5	110 to 7,520	7,060	3,970
Swiss chard	60	15	1,648.22	496	80 to 7,620	15,993	8,200
Bambara nuts	90.9	11	532.9	190	64 to 2,275	3,383	2,330
Cassava	84.6	13	708	480	105 to 2,270	6,273.18	3,600
All nine crops	62.8	-	4,381	2,450	12 to 19,050	-	-

Table 30 shows the characteristics of the loss makers across the crop types grown by the farmers at the irrigation scheme. The majority of those making losses are the farmers that grew cash crops of tomatoes, cabbages and sugar beans. The ranges of losses (i.e. negative gross margins) are highest for tomatoes, cabbages, maize and sugar beans, showing the riskiness of these crops. These crops (except for sugar beans) are very perishable thus requiring a ready market to prevent losses.

Table 30: Negative gross margins for the main crops

Crop	Loss makers as proportion of all growers		Negative gross margin R			Gross Margin R/Ha	
	%	N	Mean	Median	Range	Mean	Median
Maize	42.5%	87	1,902	1,240	7,850 - 110	3,724	3,250
Tomato	52.4%	21	2,011	1,445	8,395 - 238	13,939	9,060
Cabbage	69.2%	13	2,296	1,930	7,192-54	8,782	9,650
Groundnuts	2.9%	35	515	515	515	1,717	1,717
Sugar beans	66.7%	15	924	473	3,320 - 65	3,555	2,075
Sweet potato	18.2%%	11	770	770	770	1,963	1,963
Swiss chard	40%	15	662	390	1,950 to 120	3,137	2,775
Bambara nut	9.1%	11	60	60	60	400	400
Cassava	15.4%	13	610	610	780 to 440	8,533	8,533
All nine crops	35.1%	-	2,906	2,660	6,965 to 110	-	-

When overall gross margins, gross margins per crop and gross margins per hectare were compared between the three land tenure types (PTO holders, tenants - given by relatives and renters, and self-acquired) there were no significant differences across groups, signifying that the type of land occupancy does not have a statistically significant impact on the gross margins attained. Although the tenants expressed a sense of insecurity of tenure in their usage of the plots, this was not evident in the crop incomes they achieved.

Table 31 below shows significant correlation coefficients for a number of crop characteristics, such as income per farmer, gross margin, area planted, number of family members used as labour, and cost of labour hire. The cost of labour hire is used as a proxy for the number of labourers hired or the number of times labour was hired, as these

are proportionate to the amount spent on labour cost. It was difficult to estimate the actual numbers of labourers hired as farmers do not recall such numbers, but they knew the activities that labour was hired to undertake and the amounts paid per unit of land.

Maize income and gross margins had positive and significant correlations with area planted, the cost of labour and the number of family labourers used. This positive association shows increased efficiency in maize production in terms of area planted, and labour usage (household and hired). The positive relationship between maize area planted and the cost of hired labour explains the tendency of maize farmers to hire additional labour as they increase the area planted to maize crop.

Tomato income (income per farmer and tomato gross margins) are positively correlated with hired labour usage, showing that the returns to labour hired in tomato production are associated with an increase in the income received from tomatoes. The other attributes (area planted, household labour usage) did not show any positive and significant relationships. Cabbage, Swiss chard and sugar beans showed positive and significant association between the areas planted and cost of labour hire. Like maize, farmers growing these crops tend to hire more labourers as they increase the area planted to these crops.

Table 31: Positive correlations for crop characteristics

Crop Characteristic	Pearson's r	Significance (p)
Maize income per farmer and maize area planted (n= 87)	0.39	0.000
Maize income per farmer and maize cost of labour hire (n=88)	0.48	0.000
Maize gross margin and number of family labour (n=88)	0.26	0.016
Maize areal planted and maize cost of labour hire (n=87)	0.6	0.000
Tomato income and tomato cost of labour hire (n=21)	0.75	0.000
Tomato gross margin and tomato cost of labour hire	0.48	0.03
Cabbage area planted and cabbage cost of labour hire (n=13)	0.67	0.012
Groundnut income and groundnut area planted (n=35)	0.43	0.011
Swiss chard area planted and spinach cost of labour hire (n=15)	0.8	0.000
Sugar bean gross margin and sugar bean area planted (n=15)	-0.59	0.020
Sugar bean gross margin and cost of labour hire (n=15)	-0.64	0.01
Sugar bean gross margin and number of family labour (n=15)	0.6	0.02
Sugar bean area planted and sugar bean cost of labour hire (n=15)	0.55	0.032
Sugar bean area planted and number of family labour (n=15)	-0.57	0.027

Sugar beans income (gross margin) correlated negatively with area planted and the cost of labour hired. It also showed negative correlations between area planted and number of family labour used. These negative correlations may be related to the low productivity and efficiency of the farmers in sugar bean production (also shown by the low sugar bean gross margins amongst profit makers). There is a positive relationship between gross margin and the number of family labourers used. The other crops (cassava, bambara nuts, and sweet potatoes) are excluded from the analysis shown here since they did not show any significant linear relationships.

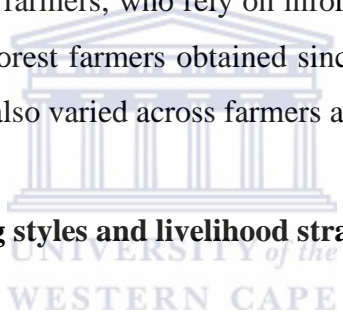
4.7.3.2 Comparison of New Forest gross margins with commercial production gross margins

The gross margins made by profit makers were compared with DAFF's COMBUD gross margin guidelines for 2011/2012 planting season. As the gross margins were extremely variable across farmers, I used the medians instead of means since extreme outliers do not affect the value of a median. Table 32 shows that groundnuts and cabbages are the only crops that have favourably comparable gross margins. Cabbage gross margins for New forest farmers are actually about three times higher than those in the DAFF guidelines. Possible explanations for this are the additional costs of growing cabbages in commercial settings, involving application of more pesticides, more hire of casual labour, and marketing and transportation costs (Whitehead and Archer 2011). The costs for casual labour and pesticides are lower for New Forest irrigators, while the other costs (marketing and transportation) are non-existent for them.

Table 32: Comparison of gross margins per hectare between New Forest profit makers and DAFF guidelines

Crop	Median gross margin /ha New Forest profit makers	Gross margin/ha DAFF⁸	Proportion of profit makers meeting DAFF gross margins/ha
Maize (n=48)	R2, 975	R5, 075	44%
Cabbages (n=4)	R24, 475	R7, 660	100%
Sugar beans (n=5)	R1, 867	R4, 840	20%
Groundnuts (n=34)	R4, 025	R4, 497	47%
Tomatoes (n=10)	R9, 118	R110, 927	0%
Swiss chard (n=9)	R8, 200	R39, 544	11%
Sweet potatoes (n=8)	R3, 970	R29, 117	0%

The large disparity between the gross margins of New Forest irrigation farmers and DAFF's COMBUD guidelines for tomatoes, Swiss chard and sweet potatoes are explained by the huge differences in the selling prices that farmers fetch. The commercial farmers due to having more diversified markets could be getting higher prices for their crops compared to New Forest farmers, who rely on informal markets. It was difficult to measure the yields that New Forest farmers obtained since they used different measures of harvesting their crops. This also varied across farmers and within a particular crop.⁹



4.7.4 Identification of farming styles and livelihood strategies

A scatter diagram was used to explore diversity amongst New Forest irrigation farmers. Gross margins per plot were compared to the total variable costs per plot. This was applied to the 94 farmers surveyed.

⁸ Gross margins based on Department of Agriculture, KwaZulu-Natal COMBUD estimates of gross margins/ha for the 2011/2012 cropping year.

⁹ For example maize would be sold at times as individual cobs, sometimes as cobs in sacks or 'bakkies' or as grain. Tomatoes were sold in trays, sacks, buckets, or in 'bakkies'.

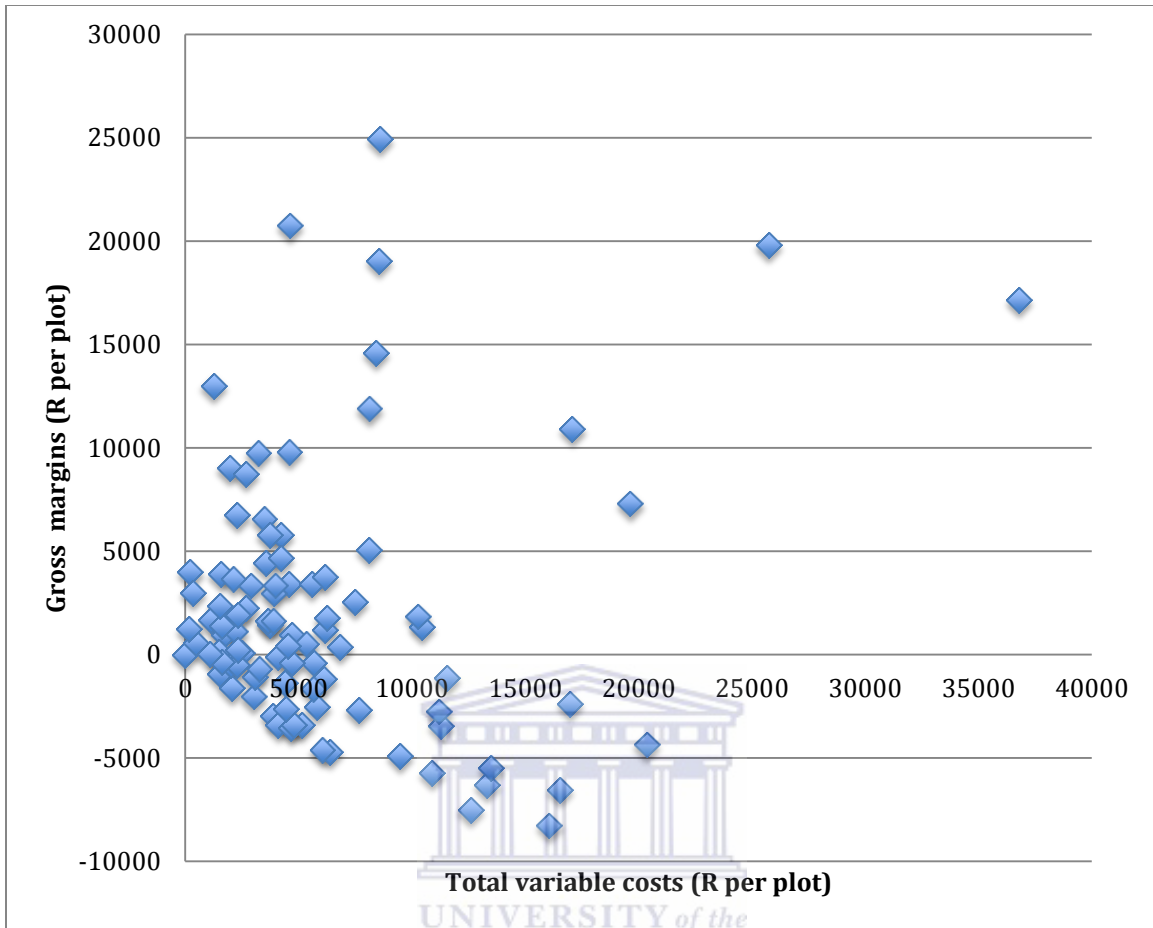


Figure 17: Relationship between total variable costs and gross margins obtained in 2012/2013 on 94 irrigation plots at New Forest irrigation scheme.

The data points were subdivided into clusters based on the relationship between gross margins and the total variable costs. These clusters are shown in Figure 18 below.

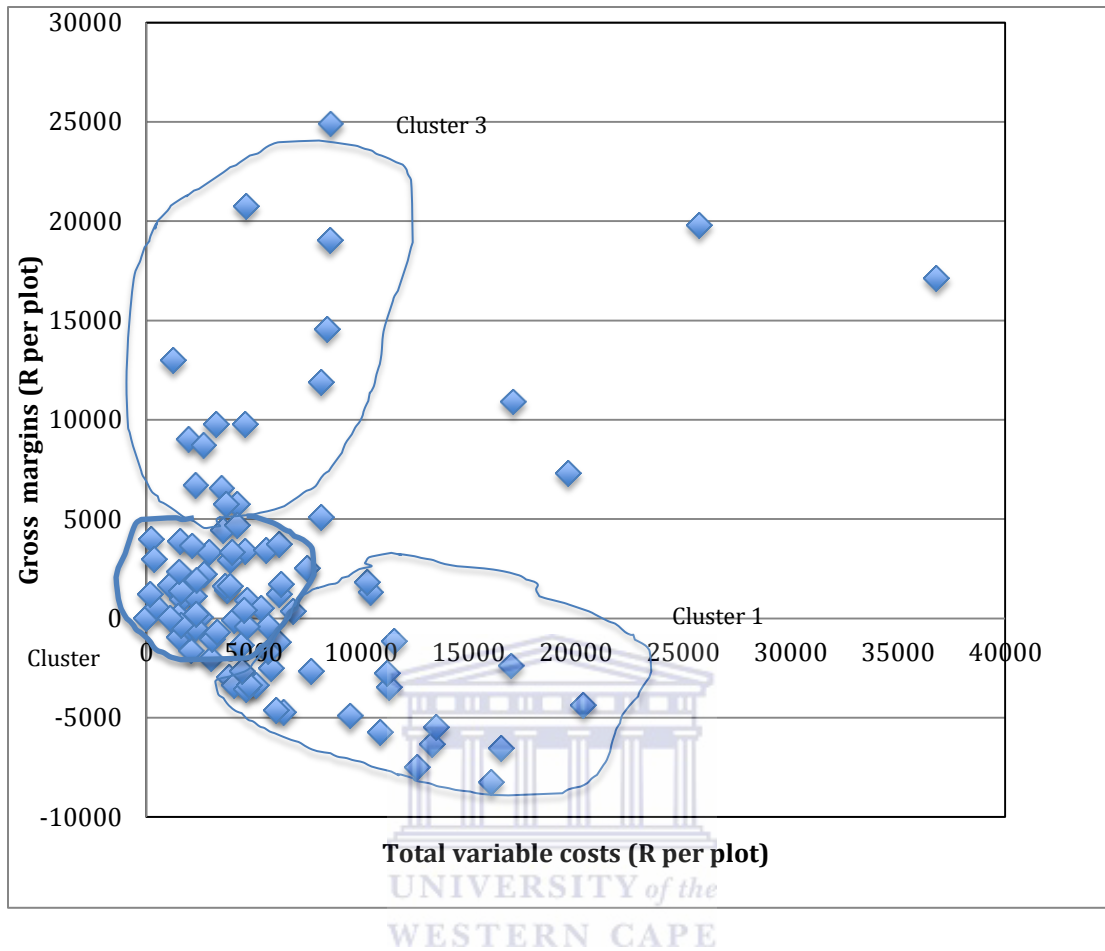


Figure 18: Farmer clusters at New Forest Irrigation scheme (n=93)

The *first cluster* stretches from left-of-centre to bottom-right of the graph and a few data points stretching to the upper right section of the graph. This cluster consists of plots that have a negative response in gross margin to increase in total variable costs. The *second cluster* has the majority of its data points bundled together at the centre on the lower left section of the graph. This consists of plots that have both variable costs and gross margins that are low, generally R2990 and less. The *third cluster* stretches from left centre to upper-left and comprises of plots where the gross margin response to increase in total variable costs tends to be highly positive and R3330 and more. About 6 data points were left out of the clusters since they represented outlier values, and could not fit into any of the three clusters.

The table below used selected variables to characterize and differentiate the three identified clusters of the New Forest irrigators based on their performance in the 2012/2013 farming season. These include total variable costs, gross farm income, and proportion hiring labour, type of labour and type of crops grown. The sample size analysed was 88 plot-holders after removing the outlier values.

Table 33: Selected variables to characterize the three clusters of plot-holder types at New Forest Irrigation scheme (n=88)

Characteristic	Cluster 1 (n=36)	Cluster 2 (n=28)	Cluster 3 (n=24)
Total variable costs	High	Low	Medium to high
Gross farm income	Low to medium	Low to medium	Medium to High
Proportion hiring labour (casual and full-time)*	63.6%	37%	34.8%
Proportion with full-time labour**	53.3%	20%	26.7%
Type of crops grown	Mostly cash crops, few subsistence crops	Mostly subsistence crops, few cash crops	Comparatively similar number of cash crops and subsistence crops

*Pearson chi square =6.12, df=2, significant at p=0.04

** Pearson not statistically significant.

Farmers in cluster 1 have high total variable costs and low to medium gross farm incomes. The majority of these farmers (significantly more at p=0.04), compared to the other categories also hired additional labour for their farming needs. Most of the crops grown are cash crops and a few subsistence crops. The production of mostly cash crops results in high expenditures on fertilizers and pesticides, in addition to labour hire. This cluster of farmers also has more farmers hiring full-time labour compared to the other clusters. Based on these characteristics these farmers can be classified as ‘employers’, similar to the classification of van Averbek and Mohamed (2006a: 143).

The farmers in cluster 2 have low total variable costs and low to medium gross farm incomes. Compared to the other farmer types they have the least number of farmers hiring additional labour for their farming needs. These farmers also grow mostly subsistence crops and a few growing the cash crops. By virtue of their labour hiring practices and the majority of crop types grown, their total variable costs remain low. The food produced is used primarily to supplement household food requirements, while

excess production is sold. The characteristics of these farmers depicts those engage in the farming style referred to by van Averbek and Mohamed (2006a: 143) as ‘*food farmers*’, whose agriculture is primarily aimed at producing food for own consumption.

Production on plots in cluster 3 is comprised of a comparative proportion of farmers growing cash crops and subsistence crops. The total variable costs and gross farm income range from medium to high. The returns to their total production costs are relatively high compared to the other two clusters. Their average gross farm income relative to total variable costs was high at a ratio of 3.96 (see Table 36 below) and was significantly different ($P < 0.05$) and higher than the other clusters. The farming style of these farmers can be labelled as ‘*profit-makers*’ (van Averbek and Mohamed 2006a:144).

Table 34: Proportion growing different crops for farming styles of New Forest irrigation farmers

Cash crops	Employers	Food farmers	Profit makers
Maize (n= 82)	40.2%	32.9%	26.8%
Tomato (n= 19)*	47.4%	10.5%	42.1%
Cabbage (n= 10)	60.0%	30.0%	10.0%
Swiss chard (n= 15)	38.5%	23.1%	38.5%
Subsistence crops	Employers	Food farmers	Profit makers
Sugar beans (n= 15)	40.0%	26.7%	33.3%
Groundnuts (n= 35)*	22.9%	51.4%	25.7%
Sweet potato (n= 11)	27.3%	36.4%	36.4%
Cassava (n=13)	30.8%	46.2%	23.1%
Bambara nuts (n= 11)*	9.1%	72.7%	18.2%

* Pearson chi-square significant at $p \leq 0.05$.

Table 34 shows the proportion of farmers that grew cash crops and subsistence crops across the farming styles categories. Only three crops showed significant differences across the farming styles. There were more employers and profit makers growing tomatoes than food farmers. Given the riskiness of tomato production (high input costs, high perishability and need for a ready market), comparatively few food farmers grew this crop. On the subsistence crops, the significant and highest proportions of food farmers growing these were on groundnuts (51.4%) and bambara nuts (72.7%). The other crops showed inconclusive differences across farming styles.

Table 35: ANOVA calculations of social and income characteristics across farming styles of New Forest Irrigation scheme (n=88)

Characteristics *	Employers (n=36)	Food farmers (n=28)	Profit makers (n=24)	Total (n=88)
Age of household head	62 _a	59 _a	56 _a	60
Household size	5.6 _a	6.3 _a	6.5 _a	6.1
Proportion contribution of main sources of income to mean total household income of plot holders (%)				
Pensions (%)	39.5 _a	30 _a	15.3 _b	30
Childcare grants (%)	7.6 _a	12.2 _a	9.6 _a	9.6
Irrigation income (%)	52.9 _a	57.7 _a	75 _b	60
Total household income (R)	26,826 _a	27,899 _a	52,048 _b	34,043

*ANOVA analyses were undertaken using farming styles as factors. Differences between means are differences between farming styles for a particular variable. Means followed by different sub-scripted letters differed significantly ($p \leq 0.05$).

Table 35 above provides an analysis of the social and income characteristics across the farming styles of New Forest irrigation farmers. The income sources used were pensions, childcare grants and irrigation income. The other income sources (formal employment, part-time jobs and remittances) were not included in this analysis as very few farmers (<5% of the total) cited these, and the actual values were difficult to verify. The households across the different farming styles were comparable in terms of age of household head, household size, and childcare grants. These results are similar to the findings at Dzindi Irrigation scheme (van Averbeke and Mohamed 2006a: 146).

In terms of pensions, its proportional contribution to total income was similar for employers and food farmers. However, for profit makers, the contribution of pension grants to total household income was significantly less ($p < 0.05$) than that for the food-farmers and employers. On the other hand, for irrigation income, its proportional contribution to the total income of profit makers was significantly higher than employers and food farmers. This clearly shows that profit makers receive more income from irrigation farming compared to employers and food farmers. The annual total household income (R52, 048) of the profit makers was also significantly higher ($p < 0.05$) than the incomes of the food farmers (R27, 899) and employers (R26, 826).

Table 36: ANOVA calculations of crop production-related variables across farming clusters of New Forest Irrigation scheme (n=88)

Characteristics (based on per cost ratios)*	Employers (n=36)	Food farmers (n=28)	Profit makers (n=24)	Total (n=88)
Mean total gross margins per plot (Rands)	-2,932 _a	1,314 _a	8,724 _b	1,598
Annual crop income (Rands)	13,046 _a	14,368 _a	39,853 _b	20,778
Total area planted (ha)	0.91 _a	0.77 _a	0.86 _a	0.85
Mean cost of seed per ha used (R/ha)	3,207 _a	1,677 _a	2,564 _a	2,544
Mean cost of tillage services /ha used (R/ha)	2,702 _a	1,956 _a	1,977 _a	2,270
Mean cost of fertilizers ha used (R/ha)	13,599 _a	5,717 _b	8,060 _{ab}	9,598
Mean cost of pesticides ha used (R/ha)	843 _a	524 _a	555 _a	664
Mean cost of labour /ha used (R/ha)	3,909 _a	1,473 _b	1,619 _{ab}	2,520
Mean total variable costs (Rands)	7,400 _a	3,607 _b	4,925 _{ab}	5,518
Ratio of mean total gross farm income to mean total variable costs	0.57 _a	1.99 _b	3.98 _c	1.95

*The ANOVAs were done using farming styles as factors. Differences between means are differences between farming styles for a particular variable. Statistically, means followed by different sub-scripted letters differed significantly ($p \leq 0.05$).

Table 36 above shows the mean values of crop production-related variables across New Forest irrigation farming styles. The variables that are comparable across the farming styles include total area planted to crops, mean cost of seed, tillage services and costs of pesticides. This data shows that these characteristics are similar for farmers regardless of their farming style. The tillage costs are related to the area planted, since tillage services are charged per unit of land.

The annual crop income, gross margins per plot and the ratio of mean total gross farm income to total variable costs for profit makers are significantly higher than for both the employers and food farmers. These characteristics emphasise the high returns on investment in irrigation production of profit makers. Employers exhibit negative gross margins per plot, and the lowest ratio of mean total gross farm income to total variable costs (0.57) due to high variable costs (especially for fertilizers and labour). The food farmers' production costs are in-between the profit makers and the employers, as they are cautious in terms of the amount that they invest in irrigation production for home consumption.

The farming styles of the New Forest irrigation farmers can be categorized using the livelihood trajectories typologies developed by Dorward *et al* (2009:4 and Scoones *et al* (2012: 516). The food farmers fall within the '*hanging in*' livelihood trajectory. The hanging in strategy consists of farmers whose assets are held and activities are engaged in so as to maintain their livelihood levels. They do not expose themselves to large financial risks, beyond ensuring that they are able to meet household consumption through the irrigation scheme and the welfare incomes that are received by the majority of them. By hanging in, they have managed to continue farming at the irrigation scheme in spite of the adverse challenges of high production costs and inadequate access to water that they are facing.

The profit makers follow a '*stepping up*' livelihood trajectory that consists of engaging in activities and investment in assets in order to expand their activities and improve their livelihoods. Investment at the irrigation scheme results in positive financial returns. These farmers are thus expanding their production and continue to invest in the irrigation scheme. Although this group does receive welfare grants, their contribution to total household income is less important (15% for pensions and 10% for child care grants) compared to irrigation income (75%).

The employer farmers can be classified as following a '*stepping down/out*' trajectory that consists of maintaining their production but being compelled to reduce their scale of operations due to high production costs (Dubb 2013: 188). The employer farmers at New Forest irrigation scheme have not as yet begun to diversify into other enterprises compared to the cases described by Dorward *et al* (2009: 4), Scoones *et al* (2012: 516) and Dubb (2013: 188). Their high production costs (R7, 400 on average), result in these farmers obtaining the lowest crop incomes, and often negative gross margins per plot (-R2, 932 on average).

The relevance and consistency of both farming styles and livelihood trajectory categorizations was tested by applying them to the 11 farmers at the New Forest

irrigation scheme who acted as key respondents, and the results are shown in Table 37 below.

Table 37: Application of farming styles and livelihood trajectories to 11 New Forest irrigation farmers

Name of farmer	Farming style	Livelihood Trajectory	Key characteristics
Thabisile	Profit maker	Stepping up	Single parent, 1.2ha plot (PTO holder), grew tomatoes, maize, butternuts, and beetroots. Poultry and petty trading
Derick	Profit maker	Stepping up	Married, 1ha plot (PTO holder), grew maize, cabbage, spinach, butternuts, chillies. Childcare grants (2).
Allan	Profit maker	Stepping up	Married, 1ha plot (renting), grew maize and tomatoes. Childcare grants (2).
Phineas	Profit maker	Stepping up	Married, 1.4ha plot (PTO holder), grew maize, tomato, cabbage and groundnuts, Childcare grants (4).
Mary	Profit maker	*Hanging in	Married, 1.4ha plot (PTO-holder), grew maize, spinach and sweet potato, pumpkin leaves, and okra. Spouse employed full-time.
Kenny	Employer	Stepping down/out	Married, Retired. (PTO holder) grew maize, cabbage, pension (2)
Angela	Employer	Stepping down/out	Single parent, (self-acquired plot) grew maize only, Childcare grant (1).
Musa	Employer	*Stepping up	Married, 1.4ha (PTO holder, and self-acquired land) grew maize, tomatoes, cabbage and butternuts. Spouse employed.
Sam	Food farmer	Hanging in	Widower, Retired. 1.2ha plot (borrowed land), grew maize and tomatoes, pension (1)
Janet	Food farmer	Hanging in	1.3ha plot (PTO holder), grew maize, groundnuts, sweet potato, bambara. Pension (1), Childcare grants (1).
Rose	Food farmer	Hanging in	Married, 1.2ha plot (renting). Grew maize, groundnut, bambara, sweet potato. Pension (1).

*These farmers had a farming style that differed to the livelihood trajectory

The farmers that are classified as profit makers are Thabisile, Derick, Allan, Phineas, and Mary. The classification of the first four farmers agrees with the information provided via in-depth interviews. All these farmers made profits from their plots during the 2012/2013 season, and they are stepping up their production and growing a diverse range of crops such as maize, tomatoes, cabbages, and butternuts. Thabisile, in particular, has been able to use her income from irrigation production to diversity into poultry production and petty trading, while exploiting alternative markets for her produce such as hawkers, ‘bakkie’ traders, and supermarkets. Derick has also been able to secure access to supermarkets, supplying cabbages and chillies. Thabisile, Derick and Allan have expressed their desire for more irrigation land in order to increase their crop production.

Mary, in contrast, although she made a profit from her irrigation plot, seems to be following a hanging-in type of livelihood trajectory. In her interview she claimed that the main purpose of farming for her is household consumption, and to obtain income from excess production. Her crop types are biased towards subsistence production. Her ability to make a profit is probably related to the salaried income that her spouse provides for purchasing crop inputs and tractor-hire. Mary is thus likely to be following a food farmer type of farming style and a hanging in livelihood trajectory, despite her classification as a profit maker using purely quantitative data.

The irrigators that are classified as following an employer farming style are Kenny, Angela and Musa. Kenny and Angela's characteristics closely fit the employer farming style. Both farmers are quite old, hired full-time and casual labour, and made an overall loss from their irrigation plots during the 2012/2013 growing season. They follow a stepping down livelihood trajectory characterized by negative returns to crop production. Musa, although classified as an employer, seems to be following a stepping up livelihood strategy. She grew a broad range of crops (maize, tomatoes, cabbages, and butternuts) for sale to 'bakkie' traders and hawkers. In addition to the land that she inherited from her father, she also recently cleared additional unallocated land in order to increase her irrigation production. She also claimed that farming was her most important income source from which she sends her children to school and there was a period that she used to take care of her husband when he was unemployed.

Sam, Janet and Rose were classified as food farmers. They made some profit from their plots (between R1, 300 to R1, 900). Most of their crop production is meant for household consumption and only the excess is sold for cash. Except for Sam, who has his guaranteed market contacts, Janet and Rose do not have ready markets but rely on spot market transactions for their crops. Most of the crops grown include maize, groundnuts, bambara and sweet potatoes that have been classified as subsistence crops in this study. Sam retired from formal employment and is the only farmer under this category growing

tomatoes for sale. Sam could be a farmer who is in a transition between hanging in and stepping up livelihood trajectory.

4.7.5 Irrigation scheme income analysis

The total gross margin income (in rands) received at the entire irrigation scheme was calculated to estimate the profits that are obtained by all the active 150 farmers on the scheme. This is shown in Table 38 below. The column for the gross margin (GM) refers to the incomes from my sample of 93 farmers that were able to provide their crop income and cost estimates on crop record sheets. Total crop gross margins were generated by summing all the gross margins for all the 17 crops grown at the scheme by the 93 farmers interviewed.

The mean number of plots per farmer (1.46) enabled determination of the total crop gross margins for all plots used by the farmers. On average, farmers plant their fields two times per year. This was used to determine the annual gross margins per year achieved by the farmers.

Although some farmers made a loss while others made a profit, the total net gross margins were positive. The table shows that the total crop gross margins for all crops grown by the 93 farmers interviewed on a single plot were R195, 589.94. This represents the total income that farmers received after catering for variable costs of production (inputs, tillage and labour). This figure is positive indicating a favourable income. The total crop gross margin for all plots used (using average of 1.5 plots) is also favourable at R285, 561.31. New Forest irrigators plant on average twice a year giving a total annual gross margin of R571, 122.62. This is the annual income received by the 93 irrigators (that provided cost and income values for their crops) during the 2012/2013 season. The average annual gross margin per household, although positive, is low at R6, 141.10, due to the wide variance across the farmers. This translates to R921, 165.52 for all the 150 active irrigators at the scheme. These favourable figures show that the New Forest irrigators are financially productive in spite of the challenges of water and access to inputs that they face.

Table 38: Total gross margins at New Forest irrigation scheme for all crops grown

Gross margins	N	Sample farmers (n=93)
		Total GM for all farmers growing crops
Mean Gross margin per farmer (R)		2'103.12
Total Crop Gross Margins (R)		195'589.94
Mean number of plots per farmer	1.46	
Total Crop Gross Margins for all plots (R)		285'561.31
Number of times planted in a year	2	
Annual Gross Margins per year (R)		571'122.62
Annual Gross Margin per household (R)	1	6'141.10
Annual Gross Margins for active farmers (R)	150	921'165.52

Because this analysis masks the diversity of farmers at the scheme, the gross margins were also calculated after disaggregating farmers into employers, food farmers and profit makers, as shown in table 39 below.

The average gross margins per farmer were negative for farmers in the employer category, at -R2, 932.46. This translates into negative annual gross margins of -R308, 260.20 for all the employers sampled, and negative annual scheme gross margins of -R525, 443.51 when applied to all active employers in the scheme (41% of the total). These figures reinforce the conclusion that employers incurred losses and made negative returns on investment in crop production due to high production costs, especially labour costs. As irrigation production is not profitable for them, they are likely to scale down their efforts in irrigation production and/or diversify into other less risky activities.

The food farmers produced a low, but positive average gross margin per farmer of R1, 314 per crop. This translated to low, but positive annual gross margins (R107, 443.27) for all food farmers sampled, and annual scheme gross margins (R183, 141.94) when applied to the proportion of all active food farmers in the scheme (32%). These figures confirm the findings from the farming styles analysis that food farmers make reasonable amounts of farming income, that enables them to supplement their household consumption through their participation in the irrigation scheme. These farmers are likely to continue to hang-in so that their household consumption needs are met.

The profit makers obtained a positive and high average gross margin per farmer (R8, 723.65). This translated to high and positive annual gross margins (R611, 353.39) for all profit makers sampled; and positive and high annual scheme gross margins (R1, 042,079.65) when applied to the proportion of all active profit makers in the scheme (27%). The profit makers produced an average annual gross margin per household of R25, 473.06, higher than the annual state old age pension amount of R14, 400 per person (R1, 200 x 12). These income figures concur with the farming styles analysis, which suggests that profit makers are able to reap high profits from irrigation production, which through continued investment is likely to result in expansion of their operations and thus higher profits over time. These farmers are eventually likely to develop into small capitalist farmers (Cousins and Chikazunga 2013).

Table 39: Total gross margins at New Forest irrigation scheme across employers, food farmers, and profit makers

Gross margins	n	Employers (n=36)	Food farmers (n=28)	Profit makers (n=24)
		Total GM for all farmers growing crops	Total GM for all farmers growing crops	Total GM for all farmers growing crops
Mean Gross margin per farmer (R)		(2'932.46)	1'314.13	8'723.65
Total Crop Gross Margins (R)		(105'568.56)	36'795.64	209'367.60
Mean number of plots per farmer	1.46			
Total Crop Gross Margins for all plots (R)		(154'130.10)	53'721.63	305'676.70
Number of times planted in a year	2			
Annual Gross Margins per year (R)		(308'260.20)	107'443.27	611'353.39
Annual Gross Margin per household (R)	1	(8'562.78)	3'837.26	25'473.06
Annual Gross Margins for active farmers (R)	150	(525'443.51)	183'141.94	1'042'079.65

4.8 Conclusions

Three types of land tenure arrangements, or types of land-holders, were identified amongst New Forest irrigation farmers. These are 'PTO-holders' (65% of the total) which is the most secure form of tenure; 'self-allocated plot-holders' (5%), also generally a secure form of tenure arrangement; and 'tenants' (30%), which is the least secure form of land tenure. Many of the 30% of active farmers are in the 'tenants' category, and have insecure land tenure arrangements. These need to be assisted to become more secure so that they can continue to invest in irrigation production and increase their productivity.

The irrigation water system cannot serve all the irrigators at the scheme, let alone the expanded plots. Farmers need assistance in obtaining adequate water for irrigation; otherwise they end up operating as dry-land farmers relying on annual rainfall. The assistance required is at the level of infrastructure repairs (canals and dam scooping), and at farmer level in terms of mobilization and organization (water committee, by-laws, maintenance issues)

The majority of farmers that made a profit from farming are those who grew maize, groundnuts, sweet potatoes, and Swiss chard, bambara nuts and cassava (mostly the subsistence crops). The higher gross margins were from the cash crops than the subsistence crops. The negative gross margins analysis shows that the higher negative gross margins were for cash crops than for subsistence crops implying that the cash crops are more risky than the subsistence crops. The overall gross margins for all the active farmers in the irrigation scheme were favourable, as farmers remain with positive incomes after catering for the production costs.

Three distinct farming styles were revealed from the study. These are food farmers, employers and profit makers. The farmers in these categories showed unique objectives, trajectories and varied degrees of exposure to risks. The food farmers focus mostly on subsistence crops production for household consumption. The positive and low gross margins obtained by food farmers showed that this income enables them to supplement

their household consumption by participating in the irrigation scheme. These farmers are likely to hang-in in irrigation production so that their household consumption needs are met.

The employers grow mostly cash crops and a few subsistence crops, and have the highest percentage hiring labour especially full-time. On average these farmers obtained negative gross margins per plot. As irrigation production is not profitable for them they are likely to scale down their efforts in irrigation production and/or diversify into other less risky activities. The profit makers have high returns to their crop production, and obtained the highest gross margins per plot. They achieved high and positive profits from participating at the New Forest irrigation scheme. Irrigation income also contributes about 75% to their household income. These farmers follow a livelihood trajectory of increasing their productivity, and ability to take more risks in increasing their profits. These farmers could be classified as small-scale capitalist farmers.

Application of the farming styles approach to the livelihood development trajectory also revealed differences across the farmers. The food farmers fall within the '*hanging in*' livelihood trajectory. These do not take a lot of financial risks beyond ensuring that they are able to meet household consumption through the irrigation scheme and welfare incomes that are received by the majority of them. The profit makers followed a '*stepping up*' livelihood trajectory that consists of expanding their production and also continuing to invest in the irrigation scheme. The employer farmers were classified as following a '*stepping down/out*' trajectory that consists of maintaining their production but compelled to reduce their scale of operations due to high production costs.

The diversity in farming styles and livelihood trajectories shown by New Forest irrigation farmers has implications on the national policy of assisting smallholder farmers and irrigation farmers. Smallholder farmers are not only different but also change their farming styles depending on their circumstances. Food farmers with an objective of supplementing their household consumption needs are more conservative and may not be willing to take the risks associated with commercial production. It should not be assumed

that they are willing to engage in commercial production. Employers are in between risk aversion and risk taking depending on their circumstances. These would be more cautious in pursuing activities that would further result incurring high costs. The profit makers, on the other hand are more willing to embrace risky activities that would result in increasing their profits. As these farming styles and livelihood trajectories are dynamic, farmers are expected to migrate from one farming style to another depending on their individual circumstances and access to resources. The correlation between farming style and livelihoods shows that the farming style pursued by farmers has an impact on the livelihood development trajectory that they will likely follow.



CHAPTER FIVE: AGRICULTURAL MARKETING AT NEW FOREST IRRIGATION SCHEME

5.1 Introduction

This chapter discusses the marketing strategies of New Forest irrigation farmers. It begins by discussing theoretical and conceptual approaches to smallholder commodity marketing, and then presents the study's empirical evidence on New Forest irrigation farmers' marketing activities. Firstly, a historical perspective on commodity marketing at the irrigation scheme is provided. The chapter then details the key marketing channels utilized by the farmers to sell the various crop commodities that they grow. A comment on the role of extension and the cooperative in marketing support to the New Forest irrigators is also provided.

5.2 Agricultural marketing: theories and concepts

This section provides a conceptual and theoretical framework of smallholder agricultural markets in order to provide a context on how marketing aspects affect smallholder farmers in general and New Forest irrigation farmers in particular.

5.2.1 Agricultural markets supplied by smallholder farmers

Harou (2011: 1) defines a market as either a physical place where exchange of commodities and money between producers and buyers takes place, or the suite of transactions between these actors taking place along a supply chain. Amrouk *et al* (2013: 6) suggest that analysis of markets should focus on both input markets (for the exchange of factors of production), and output markets (for the exchange of agricultural commodities). When farmers are engaged in a market, it is called "market participation". Amrouk *et al* (2013: 6) define "increased market participation" as the transition from subsistence farming to engagement with markets.

For the purposes of this research, markets have been defined as the channels used by New Forest irrigation farmers to sell their commodities, be these formal or informal in character.

Arias *et al* (2013: 10) argue that just as smallholder farmers are diverse, so are the marketing channels in which they participate. These markets are differentiated by size (in relation to volume, volatility and seasonality), geographic location (isolated, regional, global), connectivity to other markets, power relations between players (often defined through contractual relations), and institutional settings (infrastructure, legal framework) (*ibid*).

Chikazunga (2013a: 4, 7) postulates that, although there are varied classifications of types of markets, they can be lumped into two broad categories: formal and informal. These are differentiated by the degree of codification of the norms and procedures that govern market transactions (Arias *et al* 2013: 18). The types of commodities sold in these markets also differ, with most staples sold through informal markets while cash crops are mostly sold via the formal market system. These differences are not clear-cut, however, as there tends to be some overlapping of commodities across market types.

Informal markets include sales to neighbours, hawkers, spaza shops and 'bakkie' traders. Informal farm-gate markets tend to form the first stage in the commodification of agricultural products. Studies argue for the importance of informal markets to smallholder farmers, as the majority of them sell through these channels (Louw *et al* 2009: 14; Arias *et al* 2013:18; Chikazunga 2013b: 20). Farmers thus need to be assisted to participate in these markets whenever possible, since they have less stringent rules and requirements and lower transaction costs than formal markets.

Formal markets, on the other hand, include sales to fresh produce markets, supermarkets, wholesalers and processors, locally, regionally and internationally. In South Africa this involves participation in a highly sophisticated system dominated by a few very large players, who distribute food to a few supermarkets chains, such as Spar, Pick and Pay, Shoprite Checkers and Woolworths, often located in major towns and urban centres but increasingly found in rural areas too (Louw *et al* 2008a:2). The formalization of markets consists of a shift from informal to formal markets by smallholders (Arias *et al* 2013: 18-

19, who note that this is increasing in developing countries due to the penetration of supermarkets into regional and global value chains.

Various studies (e.g. Bijman *et al* 2007:8-9; Arias *et al* 2013:11; Amrouk *et al* 2013:6) cite the following factors that affect the ability of smallholders to transition from subsistence or lower level of market participation to fully commercial farming:

- a) *Farm and farmer characteristics*. These include education level, household-dependency structure, asset endowment, access to land, capital and available technology.
- b) *Physical and institutional infrastructure*. These include roads, electricity communications, rules, and social capital.
- c) *Technological constraints*. These include land and labour productivity, technical efficiency, and storage capacity.
- d) *Structural constraints*. These include geography, weather, culture and traditions, and legal requirements.
- e) *Risk factors*. These include price volatility, severe weather conditions, pests and diseases, and inconsistent policies.

These factors have to be examined in the context of the situation of particular farmers, including their aspirations and priorities.

5.2.2 Historical development of agricultural markets in South Africa

The development of agricultural markets in South Africa is related to the historically dualized and racially segregated development of agriculture. As whites were expanding their agricultural production with massive state support, blacks were confined to the reserves (the former “homelands”) without comparable government support (Mudhara 2010:9). Marketing of produce was state-led and a variety of marketing boards initially occupied the space for trading in agricultural commodities, and these were biased in favour of white commercial farmers (Mudhara 2010: 9). Mudhara (2010: 9) further argues that this support ensured that commercial farmers had sufficient margins to remain viable while smallholder farmers were excluded from participating in such markets.

Harou (2011: 1) and Veeman (undated: 2) claim that state-led, large-scale marketing operations were prevalent in most of the developing world in the period between the 1950s and 1980s. In South Africa, the demise of state marketing boards set in after the promulgation of the Marketing of Agricultural Products Act of 1996, that sought to deregulate agricultural markets (Mudhara 2010: 10; Scheepers 2005: 6; Qeqe and Cartwright (undated: 2). The objective of deregulation was to promote free and open agricultural markets for farmers, including black farmers. The reality is that smallholder farmers have struggled to penetrate formal markets due to the various endogenous and exogenous factors listed above. The most relevant of these factors include farm and farmer characteristics, and poor infrastructure.

In relation to production on smallholder irrigation schemes, deregulation took place before the era of Irrigation Management Transfers (see Chapter Two). In the past government's role included determining what farmers were to grow and being in charge of the marketing aspects as well (Fanadzo *et al* 2010: 3515). Transfers were seen as part of the solution, shifting government roles to farmers and hoping that existing market supply chains would continue to function (Perret 2001:5-6). This occurred during the final stages of white minority rule and at the beginning of the period of majority rule. But funding had declined and smallholder farmers had not been provided with marketing skills. This resulted in either the collapse or suboptimal operation of the irrigation schemes (van Averbek 2012: 419).

Linked to these developments was commercialization of smallholder irrigation schemes. This manifested in some schemes through linking farmers with commercial partners/joint ventures involved in the production and marketing of agricultural commodities on behalf of farmers, who just provided their land and received dividends (van Averbek 2012: 430; Makhathini 2010:25). Not all of these schemes were successful, as power relations were unequal or disgruntlements arose due to the divergent needs of those involved and the degree to which they received any benefits.

Recently, through the opening up of markets both regionally and internationally, a great demand for information on energy use, food safety issues, and environmental contaminants, and this is particularly the case in “fair trade” contexts (Harou 2011:1). The same period has seen the growth of supermarkets, partly as a result of growing urbanization, which have sophisticated requirements in terms of product handling, storage, food standards and safety issues (Louw *et al* 2009:6-9).

This has seen the restructuring of production and wholesale processing, and the retail sector in turn changing and consolidating, resulting in centralized sourcing from large farms (Harou 2011: 1). Vertical integration is another option pursued, whereby companies whose sole role is processing begin to produce from their own farms as well as engaging in downstream processes such as distribution logistics (Spore 2012: 13). These initiatives have all affected the ability of smallholder farmers to access these formalised markets.

Sourcing from small farms has been made possible through social responsibility initiatives and Black Economic Empowerment (BEE), provided that small-scale farmers are organised in groups, through collective action that enables economies of scale. The success of these initiatives hinges on factors such as social capital, the ability to be consistent in relation to the quality and quantity of produce, and farmer access to resources (such as inputs and finance), which is not always guaranteed.

Other options available for smallholder farmers include resource-providing contracts and forward contracts. These often not only provide farmers with guaranteed markets and prices, but also access to inputs and technical support. Contract farming often involves forward agreements (verbal or written) specifying the obligations of farmers and buyers as partners in business (Will 2013:16). Will further notes that there is great variability with regard to the substance, form, and process aspects of concluding such contractual arrangements.

Contracts involving smallholder farmers are generally set through unequal relations, resulting in exploitative relationships between sellers and buyers. Smalley (2013:16-17) notes that the reasons for contractual problems include the monopolistic tendencies of buyers, information asymmetry and difficulties in enforcing contracts, resulting in farmer defaults. Farmers are bound to be exploited due to weak social capital, lack of knowledge, and lack of agents that understand them and are able to negotiate and represent them.

5.3 History of marketing at New Forest Irrigation Scheme

When the New Forest irrigation scheme was transferred to the black farmers by government in the 1970s, it facilitated the purchasing of farmers' produce. Farmers thus did not worry about where to sell their produce but concentrated on the agronomic aspects of farming. After the transfer of management responsibilities to farmers, the marketing of commodities at the New Forest irrigation scheme has suffered, due to the farmers' "dependency syndrome" as well as capacity constraints.

At the present moment, despite government facilitating the establishment of irrigation cooperatives and providing extension support, the marketing of commodities is not effectively coordinated. Each farmer grows his/her own commodities and is responsible for his/her own marketing. The lack of marketing support has resulted in a marketing "gap" that is further compounded by the way that formal markets operated by the private sector are not able to engage effectively with smallholders.

The case of Janet, who is one of the oldest farmers on the scheme, shows the trajectory of decline in marketing organization at the New Forest scheme through the years. She recalls that long ago (between the 1970s and 1980s) the government used to hire trucks and bulk up their produce for sale at designated markets. She recollects planting 0.6 ha blocks to green maize and the government sourcing a market for the farmers, and she was able to get a good income as a result. Those were the years when she was a 'successful farmer'. Currently Janet is struggling to market her produce and thus mostly grows for household consumption.

5.4 Agricultural marketing channels

5.4.1 The national context

The agricultural commodities traded by New Forest irrigation farmers include green maize, tomatoes, cabbages, spinach, sugar beans, sweet potatoes, chilies and cassava. A brief discussion of some of the crops monitored by the Department of Agriculture, Forestry and Fisheries (DAFF) is given below to provide background information on the national context in which those crops relevant to the irrigation scheme are marketed. Chilies, cassava and spinach will not be discussed since DAFF does not produce annual market monitoring reports on these crops

Maize

The maize sector in South Africa comprises both the commercial and non-commercial farming sectors, the latter being located mostly in the Eastern Cape, Limpopo, Mpumalanga, and KwaZulu-Natal provinces (DAFF 2014: 11). As most of the maize produced in South Africa is consumed locally, the domestic market is important to the industry. The major buyers of maize grain in South Africa are food and feed processors, and the largest uses of maize include human consumption, and animal feed consumption, with very little used for gritting and biofuels (Louw *et al* 2010: 59).

The maize produced by New Forest irrigation is mostly for human consumption, in the form of the green mealies sold to 'bakkie' traders, hawkers, and local consumers. The market for maize grain is either insignificant or non-existent due to the availability of affordable maize meal in the local supermarkets.

Cabbages

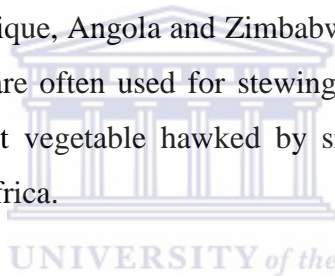
At national level, cabbages are mostly produced for and marketed through the national fresh produce markets (75% of production), chain stores (supermarkets), through the informal market, and as exports (DAFF 2010a: 3). DAFF (2010) further notes that there has been a downward trend in production volumes between 2000 and 2009. This decline

in production is attributed to increasing production and input costs and unfavourable climatic conditions.

At the level of the New Forest irrigation scheme, cabbages are the second most important crop after green mealies, in terms of the number of farmers marketing through hawkers. From the 11 farmers interviewed through in-depth life history interviews, only one farmer managed to sell his cabbages to supermarkets through a loose arrangement.

Tomatoes

Tomatoes in South Africa are not only cultivated commercially, but are also grown by resource-poor households and home gardeners (DAFF 2012a: 3). The national fresh produce markets in South Africa are the main formal marketing channels for tomatoes, with major exports to Mozambique, Angola and Zimbabwe, and a small extent to Europe (*ibid* 2012a: 8). As tomatoes are often used for stewing and to complement the staple, maize meal, it is an important vegetable hawked by small-scale entrepreneurs in the informal sector across South Africa.



At the New Forest scheme, an unreliable market for tomatoes together with their high perishability results in some farmers experiencing high rates of spoilage. There are only a few farmers (21%) that grew tomatoes during the 2012/13 planting season. The high costs of seed, fertilizer, and pesticides are other deterrent factors.

Dry beans

In South Africa, three types of beans are produced: red speckled beans, small white canning beans, and large white kidney beans (DAFF 2012b: 3). Red speckled beans command the biggest market share and are commonly sold in supermarkets as sugar beans. Dry beans produced locally cannot meet the demand, resulting in significant imports of dry beans from China, Brazil and neighbouring African countries. Mpumalanga province is the largest producer of dry beans, followed by Free State and Limpopo provinces (NAMC 2004: 269). The formal marketing channels for dry beans include selling via brokers, who in turn sell to canners and pre-packers for onward

wholesaling and retailing (*ibid*). The type of dry beans grown by New Forest irrigators are sugar beans. They sell these to hawkers, followed by local sales, and a few farmers sell to ‘bakkie’ traders.

Sweet potatoes

Sweet potatoes are grown by commercial farmers as well as smallholder farmers in South Africa. The major growing areas are the Cape provinces, Free State and Mpumalanga. South Africa is self-sufficient in sweet potatoes as production is generally higher than demand, with some exports, though South Africa is not a major exporter of sweet potatoes (DAFF 2013: 4). The sweet potato market structure consists of fresh produce markets, the informal market, processors and direct sales to wholesalers and retailers (*ibid*). Most of the New Forest irrigation farmers sell their sweet potatoes to hawkers, and a few sell to ‘bakkie’ traders.

Sugar beans are classified under dry beans in South Africa to include the small white canning beans and the large white kidney beans. At a national level, Mpumalanga and Free State provinces recorded the highest production levels of dry beans (51.7% combined) in the 2012/13 season (DAFF 2014:34). At new Forest irrigation, sugar beans were planted between July and September, while harvesting was from July to September. Few farmers sold sugar beans locally to neighbours, while the majority used the sugar beans for household consumption.

In South Africa cassava is grown as a secondary crop by smallholder farmers and utilized for production of commercial and food grade starch (DAFF 2010c:1). The main regions cultivating cassava in South Africa are Limpopo, Mpumalanga, and Northern KZN (Ibid: 2). Cassava is planted between August and September at New Forest, while harvesting occurs a year later in July and August. It was difficult to ascertain planting rates, as farmers did not measure/count the cuttings planted. Most farmers at New Forest planted cassava for household consumption.

5.4.2 Marketing of produce by New Forest irrigators

The marketing channels through which New Forest irrigators sell their produce include 'bakkie' traders, hawkers, as well as more formal marketing channels such as supermarkets. The New Forest irrigation scheme, by virtue of its location along the main road and close to Thulamahashi Township, is well served by 'bakkie' traders that purchase their products for sale in Nelspruit, Whiteriver and Bushbuckridge. Thulamahashi Township is about 5 kilometres from New Forest irrigation scheme, while Nelspruit, Whiteriver and Bushbuckridge are within a radius of 30-50 kilometres.

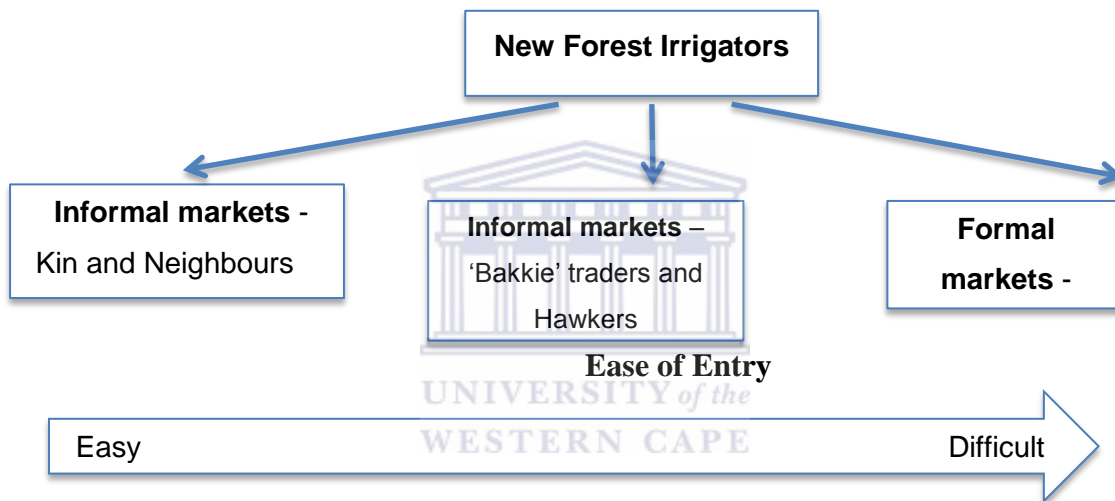


Figure 19: Alternative marketing channels for New Forest irrigation farmers

The alternative marketing channels for New Forest irrigation farmers are diagrammatically illustrated in Figure 19. The informal markets are easier to enter compared to the formal channels. Though the informal markets are easier to enter, the volumes traded through them are lower compared to formal markets.

Table 40: A comparison of the major marketing channels for the key crops grown by the proportion of New Forest irrigation farmers

Crop	'Bakkie' traders	Hawkers	Local sales	Local supermarkets
Maize (n= 69)	82.6%	15.9%	1.4%	-
Cabbage (n=11)	81.8%	9.1%	-	9.1%
Tomato (n=20)	75%	25%	-	-
Spinach (n=16)	18.8%	81.3%	-	-
Sugar beans (n=12)	8.3%	50%	41.7%	-
Sweet potato (n=12)	8.3%	91.7%	-	-
Chilies (n=8)	-	87.5%	-	12.5%
Cassava (n=9)	-	88.9%	11.1%	-

Table 40 shows the marketing channels utilized for the major crops grown by the proportion of irrigators. The maize crop is mostly sold to 'bakkie' traders as green maize. These are the largest purchasers of green maize, followed by hawkers who sell produce along the road and in Thulamahashi Township. The small proportion of maize sold through local sales accounts for the balance of the produce. The highest proportion of farmers selling through 'bakkie' traders sold maize, followed by cabbages, tomatoes, and then spinach.

The commodities mostly sold through hawkers include sweet potatoes, cassava, chilies, spinach and sugar beans. A smaller proportion of farmers also sell sugar beans, cassava, and maize to local neighbours. The few farmers that have participated in formal markets have generally sold chilies and cabbages.

A pattern emerges from this data. Most of the commodities sold to 'bakkie' traders are perishables such as green maize, cabbages and tomatoes. This implies that for farmers to be able to grow perishable commodities profitably they need good linkages with 'bakkie' traders who can purchase larger volumes than hawkers. The commodities sold to hawkers are generally non-perishable, with the exception of Swiss chard, which is grown in smaller quantities and can be harvested as and when hawkers come to purchase it.

If one examines the commodities mostly sold to 'bakkie' traders (green maize, cabbages and tomatoes), these same commodities are also sold to hawkers, although by

comparatively fewer farmers. These commodities are also seldom sold to neighbours, kin and supermarkets. This implies that hawkers are also moving perishable commodities, although to a lesser extent than ‘bakkie’ traders, while this does not apply to local sales and supermarkets. Though supermarkets are able to buy and sell perishable commodities, the majority of New Forest farmers have not been able to access this market channel.

Figure 20 shows the distribution channels of vegetables at national level during the 2012/13 marketing period. The vegetable types recorded include green maize, tomatoes, cabbages, squashes, carrots, pumpkins and onions. This chart shows that the major marketing channels for vegetables in South Africa are fresh produce markets (46%) followed by direct sales and own consumption (43%). New Forest irrigators have not penetrated the main national selling channel (fresh produce markets) to a significant degree, and are mostly selling their vegetables through loose value chains. As shown above, this includes ‘bakkie’ traders and hawkers. Instead of trying to link them to the major fresh produce markets (that are located at great distances, such as in Johannesburg, and Tshwane) efforts should be made to strengthen the direct sales channel, as it is located nearby, has less stringent regulation and few irrigators are selling through it at the moment.

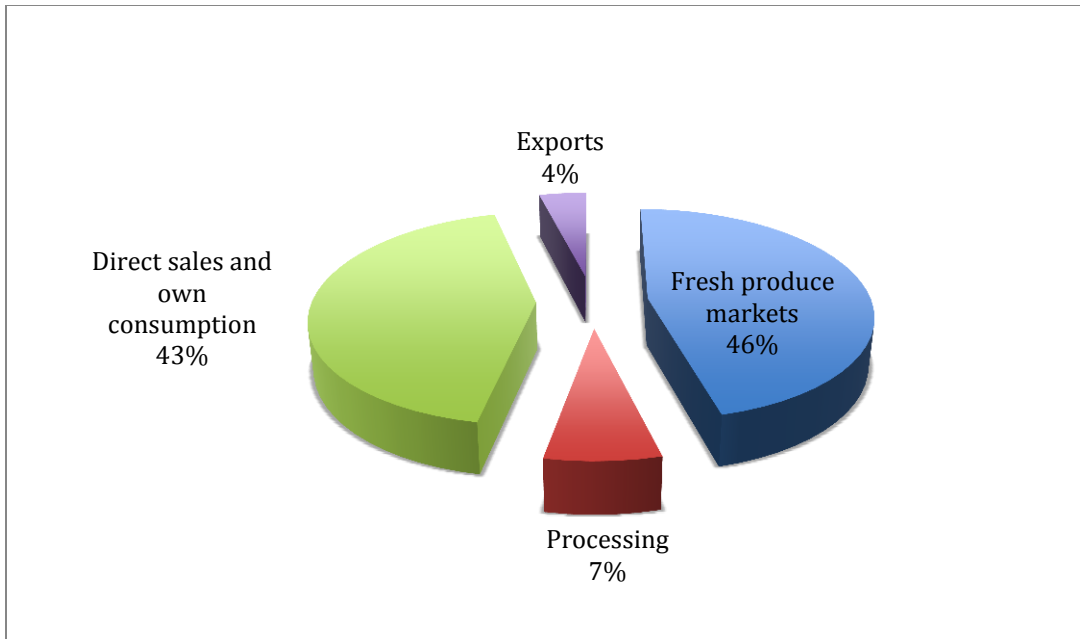


Figure 20: Distribution channels of vegetables (excluding potatoes in South Africa during the 2012/13 marketing season. Source: DAFF 2014:49.

During the interviews conducted with the farmers, I distinguished two types of ‘bakkie’ traders supplied by farmers at New Forest. There are those that purchase farm produce for resale at the nearby towns, but there are also ‘hawkers’ who hire transportation services from ‘bakkie’ owners and purchase produce for resale at the nearby towns. The first type is in the majority and purchases the largest volume of produce from the irrigators.

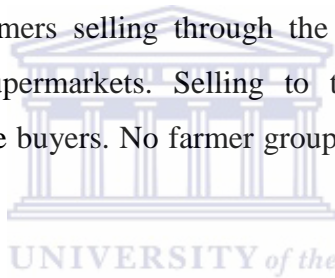
A critical success factor for selling to ‘bakkie’ traders, according to my key respondents Thabisile, Derick, Sam and Musa, is having the contact details of the traders. These four farmers do not ‘wait and hope’ that ‘bakkie’ traders will come to collect their produce, but actively communicate with them, and call potential buyers when their produce is ready for collection. Not surprisingly, these are the farmers that do not experience major challenges in marketing of their produce.

Hawkers also form an important marketing channel for the irrigators, as they buy smaller quantities of fresh green maize, sweet potatoes, yams, onions, and pumpkin leaves for resale along the road and at Thulamahashi Township. Hawkens travel on foot, bicycles,

and also utilize the taxis that ply the main road between Thulamahashi and Bushbuckridge.

Local sales to neighbours were mentioned by a smaller proportion of farmers. The commodities sold through this channel include the 'non-commercial' crops such as cassava, okra, pumpkin leaves and sugar beans. This local selling channel is based on kinship relations amongst households, as distinct from the other channels that are based on a commercial relationship.

Formal marketing channels (in this context, the supermarkets) are the preserve of the few irrigation farmers that have been able to penetrate them. They include Pick and Pay, and Spar stores. Though a few farmers have penetrated this channel, low volumes are sold at the moment. None of the farmers selling through the supermarkets have established formal contracts with the supermarkets. Selling to the supermarkets is based on individual negotiations with the buyers. No farmer groups are selling through the formal marketing channels.



For the 11 farmers interviewed, only two (Thabisile and Derick) have managed to sell to supermarkets. Their secret lies in the ability to provide the produce required by the supermarkets, in the right quality and volumes. The crops include chilies, butternuts and cabbages. Thabisile believes that in order to participate in the formal markets, such as supplying a Pick and Pay store, one needs to produce large quantities and the right quality of crops. Both Thabisile and Derick have been hiring 'bakkie' traders in their individual capacities for transporting their produce to Pick and Pay in Nelspruit. Thus far they have been satisfied with the prices received.

Table 41: Classification of 11 New Forest irrigation farmers in terms of their marketing ability

Category ¹⁰	Farmers	Marketing Channels
Market oriented smallholders in loose value chains (A): Always able to market commodities	Thabisile, Sam Derick, Musa	Diversified marketing channels- school feeding program, ‘bakkie’ traders, hawkers, and supermarkets*
Market oriented smallholders in loose value chains (B): Able to market commodities most of the time	Allan, Kenny Phineas	‘Bakkie’ traders and hawkers
Subsistence oriented smallholders: Struggling to market their commodities	Mary, Angela Janet, Rose	Hawkers and local sales

* Only Thabisile and Derick were able to sell to supermarkets.

Table 41 provides a classification of the 11 New Forest irrigators in terms of their marketing channels. Of the eleven farmers interviewed, four (Thabisile, Derick, Sam and Musa) farmers are able to market their produce every time through diversified market channels (schools feeding program, supermarkets, ‘bakkie’ traders, and hawkers). These have been classified as ‘*market oriented smallholders in loose value chains (A)*’; since they are well connected to their marketing channels and this is not a constraint to their farming enterprise.

Allan, Kenny and Phineas would fall in a second category of farmers who are able to sell their produce most of the time. Allan and Kenny have the advantage of owning trucks that they sometimes use for transporting their produce to specific market locations. These have been classified as ‘*market oriented smallholders in loose value chains (B)*’, indicating that although most of the time they are able to sell most of their produce, there are instances when they fail to sell it all. They are thus not fully integrated into the marketing channels.

Mary, Angela, Rose and Janet are in a third category of farmers that struggle to market their produce. These are classified as ‘*subsistence oriented smallholders*’. This

¹⁰ This classification is adapted from Cousins and Chikazunga (2013), where they classified smallholder farmers based on their objective of farming, proportion of marketed output, contribution to household income and labour usage.

constitutes the largest group of farmers in the larger sample of irrigators. They frequently produce low quantities for sale, with the bulk of their produce being either consumed by the household or sold locally to neighbours. Angela feels that the market for her produce is not reliable, as she depends on people who come to purchase her produce once it is ready to be harvested. She says that “*each farmer looks for his/her own market. We are just farming, but have no idea of where to sell*”. This closely resembles the Spore (2012: 5) findings that the bulk of produce in the developing countries under smallholder farming is still being produced speculatively by farmers who are not sure whether or not they will be able to sell their crops.

Table 42 below shows asset ownership by these farmer categories. The asset categories used are limited to “total assets”, “transport assets” and “agricultural assets”, since no differences exist amongst farmer categories for other asset categories.

Table 42: Asset ownership by farmer categories (n=11)

Farmer category	Name of farmer	Total number of assets	Total agric assets & % of total assets	Total transport assets
Market oriented smallholders in loose value chains (A)	Thabisile	24	16 (67%)	0
	Musa	14	11 (79%)	0
	Solomon	14	7 (50%)	1
	Derick	12	6 (50%)	0
Market oriented smallholders in loose value chains (B)	Kenny	19	10 (53%)	1
	Phineas	15	9 (60%)	1
	Allan	14	6 (43%)	1
Subsistence oriented smallholders	Mary	20	10 (50%)	1
	Rose	18	11 (61%)	1
	Janet	13	7 (54%)	0
	Angela	9	8 (89%)	0

As the table reveals, in terms of total assets, there are no clear-cut differences across farmer market categories. For the ‘market oriented smallholders in loose value chains (category A)’ farmers, they have the same number of total assets owned in general except for Thabisile who has the most assets. She is obviously a positive outlier. The categories of the “market oriented smallholders in loose value chains (category B)” and “subsistence-oriented” farmers, show disparity amongst its members. The total assets

category is biased towards the number of domestic (household) assets and agricultural assets (especially hoes) since these comprise the majority of the assets.

The number of agricultural assets owned as a proportion of all assets owned, is quite high (more than 50% of total assets owned, except for Allan), underscoring the point that most of these households are farming households. Most of these agricultural assets include hoes, spades, wheelbarrows and few owning sprayers. These assets are generally adequate for subsistence and smallholder production. The fact that a few households own sprayers and none of the households own tractors contributes to the limited production levels of the farmers. The low ownership of sprayers correlates with low application of pesticides, while the lack of ownership of tractors also relates to overdependence on tillage hire services.

The transport assets comprise the cars owned by the irrigators. All the 'Market oriented smallholders in loose value chains (B)' farmers own at least one vehicle, while half of the 'subsistence-oriented' farmers own vehicles, and only one 'market oriented smallholders in loose value chains (A)' farmer owns a vehicle. Given the location of the irrigation scheme (accessible to main road network, and taxis that ply this route constantly), ownership of a vehicle may not be a precondition to the ability of marketing successfully. This is especially so if the vehicles owned are sedan vehicles rather than 'bakkies'. The bulk purchasers of the commodities from the producers are 'bakkie' traders that visit the scheme.

All in all, compared to other studies (Barret 2007:17; Amrouk *et al* 2013:6), this data does not reveal any direct relationship between asset ownership and market access and household level market participation levels. Possible reasons could be the type of assets owned and other marketing constraints as explained in this chapter and the next chapter.

5.5 Role of extension officers and the irrigation cooperative in marketing

Given the constraints that smallholder farmers face in penetrating and sustaining their engagements in informal and formal markets, the role of a support system is essential. Studies have shown how critical institutional and organizational support is in bridging this gap (Arias *et al*, 2013: 15; Amrouk *et al*, 2013: 32). The latter showed that there is a positive relationship between the ability of smallholder farmers to access markets and the provision of extension and training.

The extension officers and the irrigation cooperative at New Forest irrigation scheme have not established any formal arrangements whereby farmers can access markets for their produce. Farmers are on their own when it comes to sourcing inputs and marketing their produce. The only organised initiative that is in place is the school feeding pilot programme, in which there is an arrangement of selling farmers' produce (especially vegetables) to the local schools. This arrangement is facilitated through the provincial Department of Education, as a pilot programme. Although the farmers appreciate this initiative, it does not have the capacity to purchase all the farmers' produce and there are reported payment delays from the government. Some farmers were also not happy with the purchase prices offered by the government, compared to the prices they received when selling through other marketing channels.

Extension officers cited problems with securing formal markets for the farmers owing to stiff competition from white commercial farmers around Mpumalanga Province, who are consistent in providing the required quality and quantity of produce. No formal contracts between New Forest farmers and buyers have been established as yet. Farmers produce crops that they think would be able to be bought by buyers, but without a deliberate and organised linkage to assured markets. Even for those farmers who have contact details of potential buyers, their planning is based on past demand, or the experiences they have had, rather than producing based on what the market needs now and in the future.

Access to reliable markets is a critical pre-condition for farmers to achieve higher and more consistent farm incomes. In-depth interviews with the 11 key respondent farmers reveal that these farmers considered themselves as 'successful farmers' during the periods/years when they are/were able to sell most of their produce. This suggests that successful irrigation farming is only possible when farmers are linked with reliable produce markets. The least successful years were the years in which farmers could not sell their produce due to inaccessible markets or low levels of production.

5.6 Conclusions

The historical trend of crop marketing at New Forest irrigation scheme shows a decline in the ability of farmers to sell their commodities successfully. Marketing of produce was possible for the majority of farmers when the government played a significant role. As the government disbanded state marketing boards and withdrew its marketing assistance, smallholder farmers became exposed to harsh market conditions without essential skills and the networks required.

The current marketing channels for the irrigation farmers include 'bakkie' traders, hawkers, and formal markets (mainly supermarkets). The location of the irrigation scheme is favourable for supplying the hawkers and 'bakkie' traders as it is along the main road linking Thulamashi Township and Bushbuckridge. There is no organised marketing system at the irrigation scheme as each farmer looks to secure his/her own markets for produce. There are farmers (classified as 'market oriented smallholders in loose value chains (A)') that are excelling in marketing through diversification of their marketing channels in loose value chains. For these farmers, marketing is no constraint as they are able to sell their commodities all the time. They have a direct communication channel with traders and always produce commodities demanded by the market. The 'market oriented smallholders in loose value chains (B)' farmers are able to sell their produce most of the time, with occasions when they fail to sell all their commodities. The subsistence-oriented smallholders, constituting the majority of farmers at the scheme, are

constantly struggling to market their produce. They mostly produce for household consumption as a result.

The types of commodity markets accessed by farmers determine the type of crops sold to them. Most perishable commodities such as green mealies, tomatoes, and cabbages are sold to 'bakkie' traders. Most subsistence crops, on the other hand, such as cassava, sweet potatoes and sugar beans, are sold to hawkers. With the exception of sugar beans, very few farmers sell their produce locally (and this applies especially to maize and cassava).

Formal marketing channels (supermarkets such as Pick and Pay, and Spar) are generally the preserve of the very few that are able to produce specialized crops of good quality. These crops include chilies, butternuts and cabbages. The formal marketing channel is accessed on an individual basis without formal contracts or arrangements. It is still at its infancy stage as the smallholder farmers interacting with it are few, inconsistent and produce low volumes.

Marketing of produce is thus generally a major constraint faced by farmers at the irrigation scheme. The few that are managing to sell most of their produce are the farmers that have developed contacts with key 'bakkie' traders and hawkers for their produce.

The role of agricultural extension and the irrigation cooperative in agricultural marketing needs to be re-considered, to provide assistance to enable farmers to market their produce. Important aspects include which crops farmers need to produce for which markets, mobilization of farmers for collective action, and possible negotiation with buyers on behalf of the farmers.

CHAPTER SIX: AGRICULTURAL SUPPORT SYSTEMS

6.1 Introduction

Smallholder irrigation farmers do not operate in a vacuum, but have organizations and institutions that work with them to improve their performance. This chapter focuses on agricultural support systems available for New Forest irrigation farmers. The support system currently in place is provided through the government extension services and the New Forest irrigation cooperative. To provide a wider context for the analysis, the chapter begins by discussing theories and debates on how best to support smallholder farmers, both internationally and in the South African context. The current level of support provided to New Forest irrigation farmers is then described, and whether this support is effective or not is assessed.

6.2 Conceptual definitions of Extension

Different studies differentiate agricultural extension from advisory services. Extension is sometimes defined as a knowledge and information support function for people engaged in agriculture, while advisory services are based on a request for information and advice to be provided to farmers (Williams *et al* 2008:14). The government of South Africa provides extension services mostly to smallholder farmers, while advisory services are on offer to farmers with highly commercialized operations (DAFF 2009a: 1).

The extension approach pursued by the South African government comprises technology transfer and participatory approaches, while advisory approaches utilize the project approach (DAFF 2005:6). Technology transfer includes collaborative diagnosis of farmers' challenges, and developing technologies relevant for improving their situations and conditions. This is usually coupled with extensive and on-going training and capacity building of farmers to be able to adopt the various technologies. Participatory principles stress the active involvement of farmers in all aspects of the farming cycle. For advisory services, the government provides subject matter specialists and 'encourages' the private sector to work with competent commercial farmers to provide technical advice using the project cycle approach (*ibid*).

By 2011 the Department of Agriculture, Forestry and Fisheries had developed an inclusive definition that combines extension and advisory services. They define extension as ‘*an amorphous umbrella term to describe all activities that combine information and advisory services needed and demanded by farmers*’ (DAFF 2011:1)

6.3 Purpose of extension

Rivera *et al* (2001: 9) define the purposes of extension at three levels, i.e. a stricter sense, a broader sense and the broadest sense. In its strictest sense, extension serves to transmit information for increasing production and profitability of farmers (agricultural production performance). This involves provision of technical information such as farming practices, irrigation scheduling, harvesting, storage, processing and marketing.

A broader purpose seeks to advance not only knowledge, but also a whole range of tasks and activities such as credit, inputs and marketing (within agricultural development). In an even broader sense, agricultural extension is seen to provide non-formal education and information to a wide range of audiences (farmers, youth, and community) for various purposes beyond agriculture (rural and urban extension) (*ibid*).

For extension to be effective in all the above, it should be able to mobilize the social capital of communities. This implies the coordination and grouping of farmers with similar circumstances to enable them either to benefit from synergy or make it easier for training and sharing of information. A long tradition of extension focuses on group promotion and group organization (Rivera *et al* 2001:9). Given that so many farmers need to be served and the limited number of extension staff, extension cannot be effective without engaging farmers in groups. In an irrigation scheme, farmers need to be mobilized so that they are able to work as a unified system. This will entail sharing of common resources such as water and tillage services, while also growing the same crops at the same time so as to create economies of scale through bulk marketing.

6.4 Challenges of extension

Agricultural extension and advisory services have been labelled as the weakest link militating against the full impact of government agricultural development projects (DAFF 2011:1). This section discusses some of these challenges that make stakeholders and farmers label extension as a ‘useless entity’. If governments addressed these challenges, extension could serve its purpose of empowering farmers to be productive while securing access to local and regional commodity markets.

Anderson (2008:3) asserts that providing and funding agricultural extension is faced with difficulties such as:

- a) *Challenges of scale and complexity of extension operations*
- b) *Dependence of success in extension on the broader policy environment*
- c) *Low interaction of extension with knowledge generation systems (education and research)*
- d) *Problems of accountability incentives of extension employees both upward (to their supervisors) and downward (to farmers)*
- e) *Weak political commitment and support for public extension.*

There are also minor issues that make extension an unpleasant experience for smallholder farmers. Chauke *et al* (2013:1079) notes studies in South Africa and Kenya that show that poor extension services have been identified as a contributor to marginalization and decrease in agricultural production activities of smallholder farmers. In their own study in Vhembe district municipality they discovered that although extension services were relatively substantial (78.4% of farmers accessing this service), there were access challenges as respondents mentioned that interactions were irregular and about 25.4% noted lack of any contact at all. Additionally, only 9 of the 30 irrigation schemes surveyed in the municipality obtained market information from the extension officers. Most farmers relied on other farmers for market information.

These issues are further echoed by Aliber and Hall (2012: 551) who note that although the government of South Africa has increased budgets and funding to agriculture and extension over the years, access to agricultural support by smallholder farmers is extremely limited as only a small share of households receives training and extension services. This is related to inadequate extension services, understaffing, and agricultural support not being attuned to the farmers' needs (*ibid*).

6.5 Agricultural extension in South Africa

6.5.1 History of extension

Agricultural extension in South Africa can be traced as far back as 1925 when it was set up by the then Minister of Agriculture to be managed centrally by a team leader and six extension staff for the whole country (Koch and Terblanche 2013: 107). This department grew steadily through major droughts and wars, and through the development of faculties of agriculture in universities. This era clearly focused on dissemination of information by service-oriented extensionists to the white farmers (*ibid*).

The 'dualistic' nature of agriculture was developed by the minority government of the day to support the white commercial farmers on one hand, and regulate agricultural production and land-use management in the former reserves and homeland areas (Williams *et al* 2008: 5). The extension services were thus dualised to cater for these different groups. The extension support for the whites were superior and included subsidies for a wide range of functions such as soil conservation works, boreholes, housing for farm workers, farm schools, fencing, and disaster assistance (*ibid*).

The extension services in the former 'homelands' largely undermined rural production and land-based livelihoods (Williams *et al* 2008: 6). The reasons included tiny budgets, limited extension and laws that restricted livestock carrying capacity, and controlled livestock movement. All in all, the extension services for smallholder farmers have been problematic to smallholder farmers due to issues such as lack of meaningful contact with farmers, outdated extension methods, low numbers of staff and low aptitudes of extension staff.

Williams *et al* (2008: 8) further note that from the 1990s the provision of farmers' support services was overtaken by the new institutional priorities of merging all the different homeland departments of agriculture with the extension services that had been supporting the white farmers.

6.5.2 Profiling of extension staff

After the development of the norms and standards booklet, DAFF conducted a nationwide-level baseline study to ascertain the gap between the current personnel in office and the desired levels (in relation to both numbers and quality aspects). This study was conducted to obtain a demographic profile of all extension officers in terms of: name, location (province and municipality), gender, race, age, job level, designation, qualification (and the institution where such qualifications were obtained as well as the year), the major subject associated with that qualification and their scope of work (DAFF 2009b: 3).

Based on the outcomes of the baseline survey, a basis for funding and improving the extension and advisory services was established. Table 43 has been adapted from the profile report produced on behalf of the Department of Agriculture.

Table 43: Profile of agricultural extension officers in South Africa and Mpumalanga province

Characteristic	National	Mpumalanga
Age distribution	Less than 35 years = 20% More than 35 years = 80%	Less than 35 years = 17% More than 35 years = 83%
Gender	Male = 73% Female = 27%	Male = 61% Female = 39%
Extension: farmer ratio	Highest shortfall in Eastern Cape, KwaZulu-Natal, Limpopo, and Mpumalanga provinces	43% extension officers serve in excess of 800 farmers
Academic qualifications of extension personnel against norms	Less than degree = 80.2% Degree or higher = 19.8 %	Less than degree = 77.6% Degree or higher = 22.4 %
Exposure to skills program	Communication = 9% Project management = 11% Computer training = 6% People management = 6.5%	Not specified

Source: Compiled and adapted from DAFF, 2009b.

The age distribution of extension officers shows that both nationally and in Mpumalanga in particular, the majority of extension personnel were 35 years and older. This has the advantage of staff having experience in the agricultural field, and given that most farmers are older, at least there are no generational challenges when it comes to interaction, as they are in the same age bracket.

The only drawback in having the majority of extension workers that are not young is that they may not be effective in learning and translating new techniques that farmers may require in this ever-changing world of information and technology. This is particularly so when the majority of extension workers are inadequately educated and lack degrees (77% in Mpumalanga, and 80% overall). Also, the large number of employees under-qualified, requires significant time allocations for study, which could negatively affect their interaction with farmers.

The gender statistics at national level and Mpumalanga show that there were more male extension employees than females. This is opposite to the farmer demographic gender ratios in which female farmers usually outnumber male farmers, especially amongst smallholders. This could have a negative impact in terms of women accessing extension support and advice compared to their male counterparts. This is predominantly so when it comes to one-on-one interactions rather than group interactions. The extension workers would need training on gender issues so that they are able to equitably support the needs of both males and females.

The high extension to farmer ratio in Mpumalanga could be a reason contributing to the low levels of extension-farmer interactions. The low exposure to skills essential for effective extension further compounds the situation. Without essential skills such as communication, project management and people management, it is difficult for extension services to be successfully delivered to farmers. These are the 'soft skills' that should accompany the development of subject matter technical skills.

6.6 New Forest agricultural extension

The New Forest Irrigation farmers are supported by the Department of Agriculture, Forestry and Fisheries (DAFF) that has dedicated two extension staff to the scheme. One extension staff member is based at the DAFF Offices in Thulamahashi, while the other has been hired by the cooperative, is paid by DAFF, and is based at the New Forest Cooperative Offices. The extension officer based at the cooperative is fairly new as he was hired in June 2013. The extension officer based at Thulamahashi drives to the irrigation scheme when required. He has been in his current role since 1993, with breaks in-between when he went to further his studies.

According to the extension staff, their role is to provide technical assistance to the irrigation farmers. This includes agronomic aspects (what to plant, how to plant, fertilizer application, and pest control). Extension support also includes training of farmers, assistance with marketing of produce, and assistance with purchase of inputs. The extension staff members are also involved to a less extent in land administration when it comes to issues such as change of ownership and acquiring of land from tribal authorities.

In-depth interviews with the 11 key respondent farmers reveal that besides Rose, all the other farmers have never received training from the extension staff. From the farmers' perspective, the extension officers have not really been of help to them. Angela maintains that the extension officers just visit their fields in order to record what they have planted and areas planted so that they are seen to be working. This information is also used for estimating the tillage work for the tractors, which include ploughing, ridging and disking.

Kenny and Janet contend that they used to receive training in the past from the previous extension officers. Janet mentioned that during the 1970s extension staff used to visit their fields and provide advice on farming skills. This is very different from today when they only see the extension staff during the scheduled meetings at the cooperative. Thabisile equally agrees with this by arguing that it was her mother that used to receive

training from the extension staff and not herself.

This is against a backdrop of at least 20 extension staff that supported just the two schemes of New Forest and Dingley Dale before the withdrawal of this level of government support under the homeland system (BLM 2010: 46). The ratio of extension staff to the number of farmers served is key to the type of service and the effectiveness of the extension support provided. The high ratio of staff to farmers in the past ensured that a diversity of technical skills were available to farmers, such as crop production, pests and diseases, irrigation scheduling, marketing and economics.

The methods used by the extension staff to provide assistance to farmers include visit to farmers' fields to provide advice on the spot, facilitating farmers scheduled meetings, while some farmers also come to the cooperative office to get technical advice as needed.

Extension officers cited problems with securing formal markets for the farmers owing to stiffer competition from white commercial farmers that are consistent in providing the required quality and quantity of produce. A few farmers have been able to supply to the retail chains in formal markets (Pick and Pay, Spar and Checkers) under the names of established white commercial farmers. The extension staff interviewed cited marketing as an on-going challenge for the irrigation farmers.

The irrigation scheme infrastructure is now old and inefficient, but the Department has not allocated any funds for its maintenance or rehabilitation. According to the extension officers, the previous minority government used to have dedicated personnel responsible for maintenance and repairs for irrigation schemes. This ensured that the scheme's condition was always good. The problem with the current policy is that jobs are contracted out and sometimes to unreliable contractors whose work is sub-standard.

6.7 Development of cooperatives

6.7.1 Defining cooperatives and principles

The International Cooperative Alliance (ICA 2014) defines a cooperative as an ‘autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise’. In South Africa cooperatives are promoted across different sectors, including agriculture, the consumer’s sector, financial services and worker cooperatives. The New Forest irrigation scheme cooperative closely mirrors this definition as it is a registered agricultural cooperative.

Agricultural cooperatives have enabled their members to access inputs in bulk (seed, fertilizer, pesticides, and credit), provide services (tillage services, produce bulk up, transportation, and linkages with the markets (Ortmann and King 2007a: 220). They are thus classified into farm supply cooperatives, service cooperatives, and marketing cooperatives, depending on their functionality (Ortmann and King 2007b: 43). These form the basis for the formation of agricultural cooperatives. Sumner *et al* (2014: 48) suggest that cooperative food systems emphasise working together for mutual benefits based on democratically chosen goals.

Table 44 applies the International Cooperative Alliance principles for cooperatives to the New Forest irrigation scheme cooperative. Although the guidelines mention seven key principles, some writers argue that the first three are applicable exclusively to cooperatives, while the others can also be applied to their main organizational competitor, investment-oriented firms (IOFs), (Gray, 2014: 24;Ortmann and King 2007b: 41).

From table 44, the most applicable principles to the New Forest irrigation scheme cooperative are: voluntary and open membership; democratic member control; member economic participation, and autonomy and independence. The irrigation cooperative still needs to develop to be able to adhere to the other three principles.

Table 44: International Cooperative Alliance principles and their applicability to the New Forest Irrigation scheme cooperative

ICA principles	Applicability	Comment
Voluntary and open membership	Yes	The cooperative is open to all New Forest irrigators without discrimination on gender, social, racial or religious discrimination. However the members still need to accept responsibilities of membership.
Democratic membership control	Yes	The cooperative is a democratic organization controlled by its members. Elections of office bearers are held every 3 years. Voting rights equality is evident when electing office bearers though not evident in decision making.
Member economic participation	Yes	Members contribute equitably to the cooperative through joining fees and annual subscription fees. Though there are guideline on how capital is used, the control and usage is left to the office bears, of which sometimes there are disagreements with the members.
Autonomy and independence	Yes	The cooperative is autonomous and controlled by its members by and large. Due to over-reliance on government funding, the extension staff tend to have an influence on their day-to-day operations.
Education, training and information	No	Neither training nor education has been provided to members and elected representatives to date. Information is only provided to members that frequently attend the monthly meetings or visit the offices.
Cooperation among cooperatives	No	The cooperative is not linked with other cooperatives be they local or national. The only interface they have is with the extension staff.
Concern for community	No	The irrigation cooperative has not developed to the stage of developing policies for sustainable development.

Source: Adapted from ICA 2014; Ortmann et al 2007a: 227.

6.7.2 History of the development of cooperatives in South Africa

On the international scene, countries such and Canada, Spain, Italy, India, Bangladesh and Kenya have been able to successfully develop cooperatives. The Department of Trade and Industry (DTI) has used these countries' experiences to develop the strategy for cooperatives in South Africa (DTI 2012: 20).

The benefits of cooperatives in these countries include economic development, employment creation economic ownership by local communities, and human resources development. According to the DTI, the critical success factors in these countries include

developing legislative instruments, supportive programs, and delivery instruments. Kenya and Bangladesh, for example, each developed a fully-fledged ministry responsible for cooperatives, with a dedicated minister, budget and a large staffing compliment decentralized to serve the entire country (DTI 2012:45).

The development of cooperatives in South Africa can be traced through three specific dispensations as tabled below (Table 45). Historically the cooperatives were developed to serve the agricultural interests of white commercial farmers to access resources, output markets and to provide a legal and operational framework to serve their interests. These agricultural cooperatives had access to finance through the Land Bank and a monopoly in key agricultural sectors and control of the marketing boards (Philip 2003: 17).

Although the minority government later developed cooperatives for blacks, these were neither as empowered nor resourced as the cooperatives for the white community (DTI 2012: 31). It was later, during the majority government period that cooperatives began to be developed to empower the majority black community (Philip 2003: 17). The initial thrust of cooperatives was to serve the agricultural industry, but this role was later broadened to cater for other sectors such as consumer, workers, financial services, burial society and service cooperatives (Ortmann and King 2007b: 46).

Table 45: Dispensations of cooperatives development in South Africa

Dispensation period	Official number of coops*	Characteristics
1922 to 1994	1,444 Agricultural share of coops was 70%	-Predominantly white agricultural cooperatives -Succeeded through massive government support (through Land bank, biased legislation, and subsidies and tax exemptions -Black owned coops did not benefit as white counterparts, with majority collapsing -Blacks formed other forms such as 'stokvels' ¹¹ , burial societies and credit schemes to survive in a harsh environment
1995 to 2004	4,210	-Mandate for coops moved from department of Agriculture to DTI -Fully-fledged cooperative unit established within DTI -First Cooperatives policy beyond agriculture was developed
2005 to 2009	22,030 Agricultural share of coops was 25%	-Cooperatives Act no14 of 2005 enacted -Majority of coops black women owned -Most entrants vulnerable and weak requiring high support levels -Reasons for growth were legislation, support measures and government procurement opportunities

Source: Adapted from DTI 2012, pp31-39.

*Official is based on the numbers registered and the active ones at the time.

Table 6.3 above shows that critical aspects of the development of cooperatives in South Africa that need to be highlighted. The first is that from the period 1922-1994 to 2005-2009 there was a boom in the number of cooperatives registered. The first period covered 72 years, while the second covered 9 years and the third period covered 4 years. From the first to the second period the number of cooperatives more than doubled in number even though the second period was only for 9 years. The increase in cooperatives was even exponential in the third period (2005-2009), although this period was only for 4 years.

Extrapolating from this data one would expect a continued increase in the current registered cooperatives between the periods 2010 to 2014. Although these statistics tell a positive story in terms of an increase in the number of cooperatives (a proxy measure of success by the Department of Trade and Industry), numbers do not always show progress.

¹¹ Stokvel is an informal savings club usually amongst black people that allows them to save their contributions.

The characteristics of this dispensation, for example, indicate that most entrants during this period were very vulnerable and weak requiring high and sustained external support. As the cooperatives unit is a small component of the department, it could not have the capacity and resources to support all these cooperatives. What makes this even worse is the fact that the cooperatives span across many sectors (agriculture, mining services, finance, workers, etc.), operate at different scales and require unique support.

The second aspect has to do with the agricultural cooperatives which have proportionately declined over the years. This decline is related to the diversification thrust of South African policies related to a strong focus on industrialization. Although agriculture is still seen as important in South Africa, the government feels that other service and industrial sectors are equally important. This has opened opportunities for more people (especially blacks) to take advantage of opportunities in sectors other than agriculture.

The implication of this is that although agriculture had been provided with adequate support during the minority government period, as most cooperatives were focused on agriculture, this support is now spread thinly across the other sectors too. It is thus no surprise why most agricultural cooperatives (including irrigation cooperatives) are suffering due to limited and piece-meal support from the government.

The third facet concerns an increase in the proportion of blacks in cooperatives, especially women. The high number of women beneficiaries could also indicate that most of these cooperatives are service related engaged in petty trading (e.g. stokvels). Needless to say, this increase in the proportion of black-owned cooperatives has enabled de-racialization in the cooperatives sector and accorded the previously disadvantaged blacks opportunities to participate and benefit. This had been the preserve for the cooperatives that in the past benefitted mainly white commercial farmers.

Opportunities for black cooperatives to expand have been created through legislative and support measures, but these are not adequate to support smallholder farmers. The

available resources in particular (factors of production, technical support, and financial resources) are still below the required levels. The empirical data from New Forest irrigation scheme cooperative below will serve to highlight some of these challenges.

6.7.3 Challenges of cooperatives

This section provides a discussion on some of the challenges inherent in cooperatives and some possible solutions. These inherent challenges noted in literature are applied to the New Forest irrigation cooperative.

6.7.3.1 Participation and democracy versus efficiency and capitalism

Cooperatives are built on values of equal participation of its members and democracy in decision-making. Gray (2014: 24) argues that Investment Oriented Firms (IOFs) create a context of pressure on cooperatives that privileges the needs of capital and short-term investment rather than the needs of people as articulated in cooperative use. Cooperatives articulate user-ownership, user-democratic control, and user benefit principles as discussed above. An emphasis on efficiency and a capitalist orientation are not as explicit in cooperatives compared to IOFs.

The challenge that agricultural cooperatives experience is that, given their limited income base (based primarily on member subscriptions), they need to survive and deliver on their expected roles of access to inputs, provision of services and market linkages. As described above, the government of South Africa has not been providing adequate funding and support to cooperatives. The agricultural cooperatives are thus forced to do one of three things: (1) fall out, (2) merely survive, without playing a useful role to their members, or (3) expand through diversification of their funding base. All these three options are prevalent here, as has been shown in South Africa during the periods 1995 to 2004 that showed significant declines of registered cooperatives especially agricultural and financial co-ops (DTI 2012: 34).

The fate of cooperatives has included merging, consolidation, dissolution and convergence into private firms. The New Forest irrigation cooperative would fall under

the second option in that it exists on paper with office bearers, but is not playing a significant role of assisting irrigators in their day-to-day irrigation needs. If this trend continues without external support it is likely to move to the stage of falling out. Very limited funding from the Department of Agriculture, Forestry and Fisheries is what is keeping the cooperative afloat. The third option is not likely to take place, due to lack of funding, technical capacity constraints and entry barriers. Chibanda *et al* (2009: 293) have argued that the inability of agricultural cooperatives to raise capital is one contributor to their demise.

6.7.3.2 Local embeddedness versus geographic expansion

Gray (2014: 26) contends that agricultural cooperatives, due to their user-ownership structure, enjoy the advantage of being locally embedded in their local environment. This provides needed local identity and local voice. The downside is that this affects their mobility, growth and ability to expand geographically. Key stakeholders locally such as the Departments of Basic Education, (DBE) Agriculture Forestry and Fisheries (DAFF), Rural Development and Land Reform (DRDLR), and Water affairs and Sanitation (DWAS) know the New Forest irrigation cooperative. By being locally embedded the cooperative is able to be the voice of its constituency.

This comes at the price of not having any other external links for access to information and resources for their members. If their local stakeholders cannot handle the challenges they are facing, they remain entrenched in their problems. From the interviews that I conducted with committee members, they highlighted that the only external stakeholder they have worked with is local government. They do not have any ties with the private sector or non-governmental agencies. Local embeddedness also manifests in the irrigators' limited marketing channels, as the majority of farmers rely on local and informal markets. The few that have secured access to the formal markets outside their region have done so through private initiatives.

6.7.3.3 Poor management and technical skills

The DTI (2012:54), Ortmann and King (2007b: 49) and Ortmann and King (2006: 3-4, 55) argue that most cooperatives fail due to poor management and lack of requisite technical skills. The department suggests that the major skills that are absent include sector specific competence, business skills, financial management, Information communication technology (ICT), and marketing skills. In addition to these I would also add skills in corporate governance, general management and managing group dynamics. Chibanda *et al* (2009: 300) in their study of 10 agricultural cooperatives in KwaZulu-Natal, found out that education is positively correlated to good institutional arrangements suggesting that education is a pre-requisite for the development of effective institutional arrangements (the 'rules of the game').

The New Forest cooperative office bearers consist mostly of farmers with low education levels, and they have never received any training on their roles. In one of the monthly meetings that I attended they were requesting expert technical skills in marketing and financial management as this was lacking in their resource pool.

6.7.3.4 Limited trust and social cohesion

Due to the unique nature of collective interest and participation, co-ops rely on trust, social cohesion, and collective interest amongst its members (DTI 2012:55). This is made worse by a lack of understanding of how cooperatives should be run (Ortmann and King 2006: 50). When engaging the New Forest irrigation cooperative committee, they were able to articulate their shared vision and approach, while this was not the case with the irrigators interviewed through in-depth interviews.

As a result very few farmers attend the monthly meetings held by the cooperative. The cooperative committee did mention that irrigation farmers sometimes question the usage of finances by the cooperative. Though there may not be incidences of misappropriation of funds, the irrigators are not informed on the sources and usage of funds by the

cooperative. Not providing adequate information consistently to cooperative members breeds mistrust and suspicion.

6.7.3.5 Weak cooperative organizational structures

The DTI (2012: 56) in their strategy mention that one of the factors that weaken cooperatives in South Africa is the lack of strong and viable cooperative associations and organizations. There are no existing national apex organizations for promoting the existence and development of cooperatives, especially those that work with smallholder farmers. The Department further notes that although secondary cooperatives exist, they are still to cooperate with each other in the creation of vibrant national apex bodies capable of providing financial, managerial, mobilisation, technical and networking support for co-operatives (*ibid*: 57). This is especially so when it comes to smallholder irrigation schemes in South Africa.

6.7.3.6 Government challenges

Though the cooperatives fall under the Department of Trade and Industry, the government at large is neither in the picture nor in control with regard to the following aspects:

- a) *The number of cooperatives existent and their impact (monitoring system inadequate)*
- b) *Lack of clarity about roles and contributions of different spheres of the public sector*
- c) *Limited current support-negligible, unfocussed, uncoordinated and lack of a systematic and sustained targeting on cooperatives*
- d) *Limited promotion and awareness on the cooperative business model, capacity building and training*

(DTI 2012:52)

6.7.4 New Forest irrigation cooperative

The discussion on the New Forest irrigation cooperative is divided into the normal functions of the irrigation committee and the responsibility of managing the tillage services through the use of the tractors provided to them by the government.

6.7.4.1 Functions of the irrigation scheme cooperative

New Forest Irrigation Scheme has a cooperative with a committee of seven members. These consist of the chairperson, deputy chair, treasurer, secretary, deputy secretary, and two additional committee members. The committee members are volunteers not paid by the irrigation cooperative. They offer their services on a part-time basis. The only person paid directly by the cooperative is the office clerk who works for the cooperative on a full-time basis.

Irrigators contribute R100 as joining fees and R200 as subscription fees paid annually. The other money received at the New Forest irrigation scheme is the income from tractor hire services, when irrigators hire the tractor for ploughing, disking and ridging services. This income mainly provides for the purchase of stationary, and transportation of committee members when attending meetings or when they need to travel to the offices of the Department of Agriculture. The running costs paid by the cooperative include purchase of diesel for tractor hire services, and purchase of spares for tractor repairs. The mechanic is hired part-time and is also paid through this income.

Elections for office bearers are held every three years when the tenure of the committee has elapsed. They have a constitution in place that provides governance guidelines for the committee. The ward committees represent each of the four wards of New Forest, Tsuvulani, Demulani and Edinburgh. These in turn select members to be part of the irrigation committee for the New Forest irrigation scheme. The ward committees hold meetings and also solve issues as they arise at their level while unresolved issues are sent up to the irrigation committee.

The irrigation scheme committee holds farmers meetings every month. The participants of these meetings include the committee representatives from the different wards, farmers and the extension staff. At this meeting, ward representatives report on issues that they face at ward level and carry back resolutions and information to their wards. According to the irrigation committee, each ward has two 'police' people, called the 'technical

team', responsible for inspecting and guarding water supplies. These are volunteers not paid for their services.

In order to assist farmers with a market channel for their produce, the committee signed an agreement with the Department of Basic Education for a pilot programme to supply the local schools (in eight circuits) with vegetables such as tomatoes, cabbages, and onions for the school feeding program. This has assisted farmers with an alternative 'formal' market. The programme is still in a pilot phase and has teething issues. The demand for vegetables by the schools falls short of the supply while farmers also experience delays with payments for their deliveries from the Department of Basic Education.

The cooperative is planning to build up its financial reserves to enable them to order in bulk and stock inputs such as seed and fertilizers. This would enable farmers to access inputs nearby and more cheaply compared to the current situation in which each farmer purchases their input needs from Nelspruit or Hoedspruit. The only money received by the committee from the Department of Agriculture includes funds for payment of drivers and the cooperative extension officer, and about 5% of reimbursements to cater for their administrative costs. The irrigation committee has never received any training on how to run the cooperative.

The farmers are not satisfied with the manner on which the irrigation cooperative is run. The feeling is that the cooperative is present physically but not active at all. The roles expected from the cooperative include managing the allocation of tractors to the farmers, stocking of seed for farmers to purchase, and assistance with marketing their produce. The other organizational roles expected include enforcing the rules and norms to enable irrigators to farm harmoniously. All these roles are currently not being adequately performed. The New Forest irrigation farmers do not operate as a unified or well-coordinated irrigation system, and individual farmers with their individual planting programs try to obtain a livelihood on their own by and large. The only elements bringing the irrigators together are the land and the water.

6.7.4.2 New Forest cooperative tractor tillage services

Around 2008, the government introduced tractor hire services through the Bushbuckridge local municipality, in an effort to assist farmers with tillage and thus boost productivity. This well-intentioned gesture crowded out private tractor service providers that used to supply the services of around 20 tractors in the central part of Bushbuckridge and at least 10 in the south (BLM 2010: 47). Currently it is difficult to obtain private tractor hire services, thus forcing farmers to rely on the inadequate tractors available from the irrigation cooperative. The Department of Agriculture gave the New Forest irrigation cooperative two tractors for usage by the plot holders. This was part of a pilot programme for empowering the New Forest Irrigation cooperative, with the hope that farmers would be able to stand alone rather than rely on service providers. The drivers of the tractors are paid through reimbursements from the Department of Agriculture, as described above.

The irrigation cooperative feels that the two tractors at their disposal are inadequate to cater for their needs for ploughing, disking and ridging. The cooperative is overwhelmed by tractor services requests from the plot holders. This leads to delays between the time a tractor is requested and the time the service is provided, impacting negatively on the cropping programs.

Allan is one of the many farmers that decry the irrigation cooperative tractor service that farmers receive. The challenge that he has faced with the cooperative is that when one books and pays for tractor services, the delay in serving you can take between 15 to 20 days. It becomes difficult to plan your planting schedule since the tractor could come when you no longer need it. He recalls a time when he had already bought cabbage seedlings for planting and immediately paid for tractor services. By the time the cooperative brought the tractor services his entire supply of seedlings was spoilt, that had cost him R6, 000 to purchase. One cannot expect the cooperative to meet the existing level of demand for tractors as this involves about 150 people requiring tractor services (ploughing, disking and ridging) at the same time.

The two tractors are subject to frequent breakdowns even during periods when there is adequate money for repairs. At the time of the interview (August 2013) only one tractor was working, while the other was not, requiring major repairs. The frustration that farmers have is that they pay for the tractor services in advance before services are provided.

6.7.4.3 The Department of Rural Development and Land Reform tractors

The Department of Rural Development and Land Reform (DRDLR) provides tractor services to dry-land farmers and irrigators only during the rainy season, through a contracted company. The DRDLR purchased about 20 tractors (10 for Dinglydale area and 10 for New Forest area) and then contracted a service provider to offer a service to dry-land farmers (covering approximately 1000ha of land) and performing repairs and maintenance. These tractors are housed at the New Forest irrigation cooperative offices.

Tractor service provision by the DRDLR falls under a programme called “Masibuyele Emasimini”, meaning, “Let us return to farming”. This programme was worth R500 million in Mpumalanga province and formed part of a larger Food Security and Agricultural Report programme launched between 2005/06 to 2009/10 (Sikwela 2013: 95). A total of 175 tractors were distributed across the province under this initiative.

This tractor service is free of charge to the dry-land farmers and irrigators. During the month of August 2013 all these tractors had been parked, as it was the off-season, although there were other deeper unresolved issues between the government and the service provider. These tensions were mostly in relation to unverified claims for payment by the service provider and delays in payment by the government.

What is most unfortunate about the tractors managed by this service provider is that they have many tractors that are working, but they do not assist the irrigators, since the contractual arrangement is for dry-land farmers primarily; however, irrigators do benefit during the rainy season. As only one tractor under the control of the cooperative was functional during the month of August 2013, the irrigators could not access the other 20

tractors under DRDLR. The irrigation committee has hopes that the government's plan to transfer 70% of these tractors to the management of the irrigation cooperative and leave 30% under the "Masibuyele Emasimini" dry-land farmers will be realized soon.

The 'back- and-forth' management of tractors by the provincial department has not been beneficial to the smallholder farmers. The Bushbuckridge local municipality (BLM 2010: 47) describes tractor management as follows:

Essentially the policy shifted from "tractors to be managed within each scheme" in early 2008 to "tractors to be managed by the municipality throughout the municipal area" later in 2008, to "tractors being only available for subsistence farmers and not commercial farmers" in 2009, to "tractors being suspended for budget reasons" in the first quarter of 2010.

This shows inconsistency in policy direction within the department, with negative consequences for access to tillage services by smallholder farmers. Smallholder farmers in South Africa, compared to other countries, rely heavily on tractor tillage services, without which no production will take place. In other countries (such as Zimbabwe, Malawi and Zambia) smallholder farmers tend to rely on animal-drawn ploughs and hand-hoes by those without livestock.

6.8 Conclusions

This chapter has discussed agricultural support mechanisms available to New Forest irrigation farmers that include agricultural extension and irrigation cooperatives. This was contextualized by a discussion of conceptual, theoretical and historical perspectives pursued in farmer support programmes both internationally and in South Africa.

Agricultural extension is essential for farmers, as it should serve to link farmers with authorities, resources and information, and provide them with the capacity development they need to improve their productivity. An external person in the form of extension staff also serves to facilitate negotiations and development processes taking place between and amongst farmers. The way extension support is viewed by farmers is critical in determining how they will utilize it. The current perception of agricultural extension by

farmers in New Forest irrigation scheme is negative, and farmers feel short-changed. The roles expected by farmers from extension services are not provided. There has also been a decline in the number of extension personnel serving farmers and irrigation schemes in particular.

The farming world is very competitive, especially if farmers intend securing access to formal agricultural value chains. The irrigation cooperative provides a formalised system to ensure that farmers are organised and well-linked with input and outputs markets. Agricultural cooperatives have been wrongly viewed as the panacea to solving all the problems of access that smallholder farmers have. They should be seen as a vehicle to address some of the access issues, not as an end in itself. For cooperatives to be effective in their 'vehicle roles', they require to be empowered to operate under the international cooperative principles. The role of the government should be significant, focused, coordinated, systematic and sustained over the long haul.

The current operation of the New Forest Irrigation cooperative is below the expectations of the irrigators, leaving the farmers to operate as individuals in a system they could have benefitted from association. Critical issues to be addressed include addressing cooperative governance issues, facilitation of farmer collectivization, enforcing rules and regulations of engagement, and linking the irrigators with input and output markets.

Tillage is an important component of farming for smallholder irrigators in South Africa, without which farmers cannot produce their crops. From the entire sample of 94 irrigators, only two farmers use their cattle for tilling their land, the rest rely on the two tractors provided by the irrigation cooperative. The Department of Agriculture and the Department of Rural Development and Land Reform need to put their heads together to resolve the tillage crisis that irrigation farmers face. It is unjustifiable to park 20 tractors for dry-land farming throughout the year and only release them to dry-land farmers, while irrigators need these services throughout the year.

CHAPTER SEVEN: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

This chapter presents the summary, conclusions and policy implications of the key findings from the study of the New Forest Irrigation Scheme. It begins by providing a summary of each chapter of the thesis emphasizing the salient features. It then provides a comparative analysis between the findings from the New Forest irrigation scheme in relation to the findings from irrigation schemes in Limpopo, Eastern Cape and KwaZulu-Natal, where most studies of irrigation schemes have been done. A conclusion and implications for policy is then provided.

7.1 Key findings

This thesis has sought to investigate the production and livelihoods of smallholder farmers in irrigation schemes in South Africa. The particular focus has been on the farming styles of smallholder farmers, the impact of irrigation scheme production on their income and livelihoods, and the issue of smallholder social differentiation. The New Forest irrigation scheme located in Bushbuckridge local municipality was used as a case study.

The first chapter of the thesis sought to provide the context and setting in which smallholder irrigation is practiced in Bushbuckridge Local Municipality, and at New Forest Irrigation Scheme in particular, as well as the objectives of the study and a review of the methodology utilized in my inquiry. Smallholder irrigation in South Africa has been defined by a long history that includes racial segregation policies in the past that benefited white commercial farmers, as well as issues of irrigation management transfer and revitalization which sought to benefit black small-scale farmers in rural areas in the post-apartheid era (Van Averbeke *et al* 2011:797).

The overall question that the research study explored is: ‘What is the contribution of small-scale irrigation farming to the livelihoods of farmers at New Forest Irrigation Scheme?’ The underlying assumption is that small-scale irrigation has the potential to

make a positive contribution to the livelihoods of farmers. The research methodology utilized to answer this question comprised a combination of extensive and intensive research designs as espoused by Swanborn (2010:2). The extensive research design used a household survey and a crop record sheet. These were administered to a stratified sample of 94 households from the irrigation scheme. The sample was stratified across the four wards of New Forest village, i.e. New Forest, Tsuvulani, Demulani and Edinburgh wards.

The intensive research design involved in-depth life history interviews with 11 irrigators, interviews with extension staff, and interviews with the New Forest irrigation committee representatives. This provided detailed qualitative information that helped explain some of the findings from the extensive research aspect. The combination of extensive and intensive research methods provided a deep and wide range of information that could be triangulated across the different methods. The extensive research was analysed using both descriptive statistics and methods of statistical inference such as comparison of means and proportions, chi square tests, correlations, and analysis of variance. Gross margin analysis was conducted to measure the profitability and productivity of the crops that the irrigators grew during 2012/2013-production season. The intensive research was analysed for themes, trends, and frequently cited and strong opinions. The range and diversity of participant experiences, perceptions and expressions were also considered in my analysis. In life history analysis, the themes and issues that emerged from the data were arranged into a framework that illustrated the relationship between the different variables and the participants' understanding of history, identity and present situation (Francis and Le Roux 2012:19). Chapter one concluded by outlining the general structure of the rest of the thesis.

Chapter two provided a review of the literature on smallholder irrigation schemes in South Africa. It began by offering a historical account of smallholder irrigation development in South Africa from the 19th century, when the focus was on peasant and mission diversion schemes. This was associated with missionary activity amongst the African peasantry in the Eastern Cape (van Averbeke 2008:15). This progressed to the

current phase that centres on Irrigation Management Transfers (IMTs) and ‘revitalization’ that focuses on social upliftment and making irrigation schemes more profitable to smallholder farmers. This stage saw a shift from government-operated and -managed schemes to farmer-managed schemes, with varied success. As smallholder farmers did not have adequate resources and skills to manage these schemes, production often fell, while at some schemes operations ceased altogether.

The policies that govern the management of smallholder farming in irrigation schemes such as land policies and thus tenure reform, and water policies, were assessed. The current influence of these policies on small-scale farming in general and irrigation farming in particular was elaborated on. A greater emphasis was given to the agronomic performance of smallholder irrigation schemes as this has a bearing on the livelihood of the irrigation households and how policy makers judge the contribution of irrigation schemes. The agronomic aspects emphasised in the literature include crop yields, yield gap analysis, cropping intensities, soil fertility and water management. This provided the basis for reviewing production performance in the New Forest Irrigation Scheme.

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A summary of the constraints faced by smallholder irrigation farmers was provided to show that these are numerous, and generally categorized into institutional aspects, socio-economic constraints, infrastructural aspects, and agronomic dimensions. Although this review provided a somewhat gloomy perspective on the status of smallholder irrigation schemes in South Africa, there are studies cited that noted the positive benefits of smallholder irrigation schemes. Indeed, there are multiple benefits from irrigation schemes that can be observed in the diversified objectives of those engaged in irrigation farming.

Different theories of farming styles and livelihood strategies pursued by smallholder farmers were discussed and their usefulness to the study of smallholder irrigation schemes assessed. These are relevant for the type of smallholder farmers engaged in irrigation scheme production given the diverse activities that they pursue in obtaining a livelihood. The literature on farming styles argues for the importance of farming style

classification as it recognizes that farmers are not homogeneous, be it through their resources endowments, approaches to farming, management of risks or adoption of technologies (Van de Ploeg 2010:1; Vanclay *et al* 1998:85; Schwarz *et al* 2004:33). Van Averbek and Mohamed (2006a:147) used the farming styles approach to classify farmers into ‘*employers*’ that were employing extra labour in their plots, ‘*food farmers*’ devoted to household food production, and ‘*profit makers*’ who farm primarily for selling and generating significant income. Their typology was used in this study to classify New Forest irrigation farmers, based on the way they practice agriculture, the risks they take, and the outcomes of their farming.

The farming style approach was compared with the livelihood strategies approach to determine the relationship between farmers’ approach to farming and their livelihood development trajectory. Van Averbek and Mohamed (2006a: 152) argue that particular styles are strategically and structurally congruent with particular types of livelihoods. The livelihood trajectories engaged by smallholder farmers include ‘hanging in’, ‘stepping up’, ‘stepping down’, and ‘dropping out’ (Dorward *et al* 2009:4; Scoones *et al* (2012:516). These livelihood trajectories, although neither cast in stone nor rigid, are useful for the explicit recognition of the dynamic activities and aspirations of smallholder farmers.

Chapter three presented a description of the socio-economic profile of the New Forest irrigation farmers. An introduction to the character of the population in the Bushbuckridge Local Municipality, in which New Forest is located, provided the economic and social context of the area, relying on data from both the municipality and Statistics South Africa. The data showed some key differences between New Forest irrigation farmers’ characteristics and the population of the wider local municipality data, due to the uniqueness of irrigation scheme households.

The New Forest irrigation farmers were assessed in terms of asset ownership, focusing on domestic, electronic, transport and agricultural assets. Domestic assets included the assets generally used in a household for everyday functioning, such as electric stoves,

microwaves, sewing/knitting machine, washing machine, lounge suit, gas stove, paraffin stove, and a fridge. The electronic assets were basically communication devices such as a radio, a compact disk player, a television, and a computer. The transport assets included a motorcycle, bicycle, and a motor vehicle. These assets would provide mobility to a household to travel from point A to point B either for commercial or for social reasons. The agricultural assets included a tractor, plough, wheelbarrow, knapsack sprayer, donkey cart, garden spade, garden fork and a hoe. Farmers use the agricultural assets in the agricultural production process. These are the tools of the trade that make farming possible.

The majority of households generally owned most of the domestic assets. A low percentage of households that did not have access to electricity did not own the electrical domestic assets. All the households (100%) owned at least one domestic asset. The importance of domestic assets is that they provide utility to households in terms of comfort and reducing the burden of domestic chores (usually undertaken by women) such as cooking, and washing. As households become affluent, they tend to acquire more domestic assets. Hence this was a proxy measure of prosperity in general.

Almost all the households (93.6%) own at least one electronic asset. On average 2.3 assets are owned by the households out of the 4 possible electronic assets owned, representing about two thirds of the electronic asset types available. This shows a better ownership level compared to the domestic assets. The importance of electronic assets is that they facilitate communication, information, and entertainment. The later role also fulfils a social status role in the society.

A total of 36.2% of the households own transportation assets. Though this is low, it is quite significant. None of the households interviewed owned motorbikes, while only 6.4% owned bicycles. Vehicles comprise the highest owned transportation assets, as they are owned by 30.9% of households. Of these households, only one household owns two vehicles while the rest own a single vehicle. The irrigation scheme is located in an accessible area near the main road to Thulamahashi and the other major town centres.

The road is also served by a reliable and frequent public transport system such as buses and taxis. Owning a vehicle in this case provides the independence, convenience and flexibility for irrigators either to carry inputs or their produce to various markets. Bulk purchasing is also possible if the vehicles owned by the farmers are pick-up trucks. The few vehicles that I saw at the irrigation scheme belonging to irrigators were pick-up trucks, although I could not establish exactly how many vehicle owners owned pick-up trucks.

All households owned agricultural assets, though in different proportions. The mean number of agricultural assets owned is 6, out of 8 agricultural asset types. The very similar mean and median number shows that asset ownership is not skewed. This high level of ownership reveals that New Forest households are farming households. The range (1-17) shows that there are households with very few agriculture assets owned, while some households have a large number of assets.

Tractors and donkey carts are not owned by any of the households. Households generally own few draught livestock (for example, only 14% of the farmers own cattle). Correspondingly, ploughs are owned by 3% of the households. This accounts for the over-reliance of the irrigation households on tillage services provided by the irrigation cooperative. When the irrigation cooperative fails to provide tillage services for any reason, this means that farmers will not be able to plant their crops. Farmers have noted delays in planting their crops, or even reducing the area planted, due to tractor service delays and inadequate tractors being available.

When one considers the variety of agricultural assets owned, the ownership is biased towards the hoes. Hoes are the agricultural asset that accounts for the high ownership mean (the mean number owned is 3.2) and are owned by all irrigators. The hoe is an important tool used by households for field clearing, planting seed, and weeding. The few households that cannot afford to hire tractors for tillage rely on hoes for ploughing and cultivation.

The correlation analyses involving asset ownership as key variable showed interesting results. There was, for example, a positive correlation between the number of times the farmers planted this year (2013) and last year (2012) and asset ownership, especially agricultural assets. This implies that asset ownership could be related to the number of times a household plants (cropping intensity) in a particular year. This is not surprising given the importance of agricultural assets in farm production.

Similarly, there was a positive correlation between total irrigation plot size available (this includes owned and/or rented land) and the number of assets owned. This correlation is slightly higher for agricultural assets and in particular sprayers and hoes. The relationship between agricultural assets and land size cultivated is important as larger land sizes can be made productive depending on the assets that one has. Most of the agricultural activities are labour-intensive, thus requiring adequate assets (hoes and sprayers) to perform these tasks whether using household and/or hired labour.

The income sources of the irrigators are quite few in number. Irrigation income is the most important, followed by social grants that consist of pensions and child-care grants. The uses of the incomes received by New Forest irrigators include purchase of food, education of children, domestic uses and farm production.

The in-depth vignettes of 11 of the irrigation farmers, although not representative of the farmers at New Forest Irrigation scheme, provided insights into the diversity of smallholder farmers. These vignettes were used and referred to throughout the thesis to provide a qualitative context and to assist with explanation of the research findings of my study. These were purposively sampled to be broadly representative of the villages at the scheme, and also show the dynamics of livelihood change as well as the diversity of the types of farmers present.

Chapter four proceeded to present and discuss irrigation crop management and production as practiced by New Forest irrigation farmers. It focused on the main cash crops (maize, tomatoes, cabbages, sugar beans and spinach) and main subsistence crops

(sweet potato, groundnuts, cassava and bambara nuts) that they grew during the 2012/2013 cropping season. Aspects that are relevant and had an impact on crop production were also discussed such as land tenure and land size holding, access to inputs and labour, and access to irrigation water and its management. The financial aspects of smallholder irrigation production, farming styles and livelihood trajectories were also explored.

Three types of land tenure arrangements were identified amongst New Forest irrigation farmers. These are 'PTO-holders' (65% of farmers) which is the most secure form of tenure comprising of households that either received occupation certificates from the chief or through inheritance; 'self-allocated plot-holders' (5% of farmers), also a generally secure form of tenure arrangement; and 'tenants' (30% of farmers), which is the least secure form of land tenure, comprising of farmers that do not 'own' land at the scheme but either borrow land for free or rent the land for an annual fee paid to the PTO-holder. Only 30% of the entire scheme is being utilized at the moment, and 30% of the active farmers are in the 'tenants' category, and thus have insecure land tenure arrangements. These need to be assisted to become more secure so that they can continue to invest in irrigation production and increase their level of output.

Crop inputs are not centrally purchased and planting rates also vary. Crop yields and quality differ across farmers. Farm inputs are purchased using cash mostly from social grants, as well as income from farming. The key contributors to high farm inputs costs for cash crops are high prices for fertilizers, seeds and tillage hire, while the costs of tillage and seed are the highest for subsistence crops. Fertilizers form a high proportion of the total production costs for cash crops, ranging between 48% and 65% of the total. The ability to meet these high fertilizer costs has a bearing on the profits that farmers earn from cash crops. It is essential for the government and stakeholders working with the irrigators to facilitate access to inputs, especially for cash crops. A centralized purchasing scheme for key inputs such as fertilizers and seed would enable farmers to access them more cheaply.

New Forest irrigation farmers are constrained by the limited water available for their irrigation needs. The causes include siltation of the main Orrinoco dam and the storage reservoirs, the broken down canals and leaking valves, and the informal extension of irrigation plots beyond the capacity of the water system at the scheme. The lack of a formalised and organised irrigation system (i.e. harmonization of which crops to plant, when to plant them and when to irrigate them on which section of the plots) further compounds the situation.

The impacts of the water shortages are varied and undermine production. Conflicts for water amongst the irrigation farmers are prevalent as each jostles to obtain the limited resource ahead of others. The primary result of the shortage of water is impeded growth and lower crop yields. The small percentage of farmers that are actively farming in the scheme is also due to the limited water available. The irrigation water system cannot serve all the active irrigators at the scheme, let alone the expanded plots. Farmers need assistance in obtaining adequate water for irrigation, or they will risk ending up operating as dry-land farmers relying mainly on annual rainfall. The assistance required is in relation to infrastructure repairs (canal repairs and dam scooping), and in relation to mobilization and organization of farmers (the operation of the water committee, the implementation of by-laws, and the maintenance of infrastructure).

Gross margin analysis shows that more farmers (61.3%) made a profit overall from their crops than made a loss (38.7%). The majority of farmers that made a profit are those that grew maize, groundnuts, sweet potatoes, spinach, bambara nuts and cassava (i.e. mostly the subsistence crops). A further analysis of the positive gross margins reveals that although the majority of profit makers grew subsistence crops, the higher gross margins were secured from the cash crops rather than the subsistence crops. The analysis of negative gross margins shows that the higher negative gross margins were generally for cash crops rather than for subsistence crops, implying that the cash crops are more risky compared to the subsistence crops. The overall gross margins for all the active farmers in the irrigation scheme were favourable, as farmers secure positive incomes after covering their production costs.

The total crop gross margin for all plots owned (using average of 1.5 plots owned) by farmers interviewed was positive and favourable at R285, 561.31. New Forest irrigators plant on average twice a year giving the total annual gross margin of R571, 122.62. This was the annual income received by the 93 irrigators (that provided cost and income values for their crops) during the 2012/2013 planting season. The mean annual gross margin per household, although positive, is low at R6, 141.10. This translates to a total of R921, 165.52 per annum for all the 150 active irrigators at the scheme. These favourable figures show that the New Forest irrigators are financially productive in spite of the challenges of inadequate water supplies and inadequate access to inputs. With an annual total irrigation income of R921, 165.52, it is justifiable for the government to invest in the repair and rehabilitation of the scheme.

Three distinct farming styles are present at New Forest. These are 'food farmers', 'employers' and 'profit makers'. The farmers in these categories have distinct objectives, trajectories and degrees of exposure to risks. The food farmers (32% of farmers) focus mostly on subsistence crop production for household consumption. These farmers also are less exposed to the risks of perishable crops that require high fertilizer and pesticide costs. The employers (41% of farmers) grow mostly cash crops and a few subsistence crops, and have the highest numbers of hired labour, especially full-time labour. On average, these farmers obtained negative gross margins per plot. The profit makers (27% of farmers) secure high returns to their investments in crop production, and obtain the highest gross margins per plot. Irrigation farming income contributes about 75% of their household income.

Gross margins were also calculated after disaggregating farmers into different farming styles i.e. employers, food farmers and profit makers. The mean gross margin per farmer was negative for farmers in the employer category at -R2, 932.46. The employers incurred losses and negative returns to their crop production due to high production costs, especially labour costs. As irrigation production is not profitable for them they are likely to scale down their efforts in irrigation production and/or diversify into other less risky

activities. The food farmers obtained a low, but positive mean gross margin per farmer, at R1, 314. Their positive gross margins showed that they make a reasonable income from farming that enables them to supplement their household consumption through their participation in the irrigation scheme. These farmers are likely to ‘hang-in’ irrigation production so that their household consumption needs are met. The profit makers obtained a positive and high mean gross margin per farmer at R8, 723.65. The data on the income of profit makers concurred with the farming styles analysis undertaken by van Averbeke and Mohamed (2006a: 143), which suggests that profit makers are able to reap high profits from irrigation production, and through continued investment this is likely to result in expansion of the farming enterprise and thus more profits over time.

Application of the farming styles approach to the analysis of livelihood trajectories (see Dorward *et al* 2009: 4; van Averbeke and Mohamed 2006a: 153) also revealed congruency in these approaches. The food farmers fall within the ‘hanging-in’ livelihood trajectory. They do not take many financial risks, beyond ensuring that they are able to meet household consumption through the irrigation scheme (combined with the State grants that are received by the majority of them). By hanging-in, they have managed to continue farming at the irrigation scheme in spite of the adverse challenges of high production costs and insufficient water supplies.

The profit makers conform to a ‘stepping-up’ livelihood trajectory, expanding their production and continuing to invest in their irrigation farming operations. Although members of this category do receive State grants, their contribution to total household income is minimal (15% of the total for pensions and 10% for child care grants) compared to irrigation income (75%). The employer farmers were classified as following a ‘stepping- down/out’ trajectory that consists of maintaining their production but being compelled to reduce their scale of operations due to high production costs.

Chapter five sought to examine the historical trends as well as the current status of commodity marketing at New Forest Irrigation Scheme. Marketing of produce was significant for the majority of farmers when the government played an active role in the

past. The government of South Africa was initially responsible for what farmers grew, bulking up the produce, and marketing it on behalf of the farmers. During this period, the marketing of produce was not a concern of the farmers as marketing boards played this role. As the government disbanded marketing boards and withdrew its marketing assistance, smallholder farmers became exposed to harsh market conditions without the essential skills and networks required.

Formal and informal markets are differentiated by the degree of codification of the norms and procedures that govern market transactions (Arias *et al* 2013: 18). The types of commodities sold in these markets also tend to differ, with most staples sold through informal markets while cash crops are mostly sold in the formal market system. These differences are not clear-cut, however, as there tends to be overlapping of commodities across the markets. The current marketing channels for the irrigation farmers include ‘bakkie’ traders, hawkers, and the formal markets (in the form of supermarkets). The location of the irrigation scheme is favourable to the hawkers and ‘bakkie’ traders’ channel as it is located along the main road linking Thulamashashi Township and Bushbuckridge. There is no organised marketing system at the irrigation scheme, as each farmer looks for his own markets for produce. There are farmers (categorized as ‘market oriented smallholders in loose value chains (A)’ that are excelling in marketing through diversification of their marketing channels within loose value chains. These farmers are able to sell their produce all the time. They produce commodities that they know they can sell, and also maintain good relationships with their buyers (and have their contact information). The ‘market oriented smallholders in loose value chains (B)’ type of farmers are able to sell their produce most of the time, while the majority, classified as ‘subsistence-oriented smallholders’ are constantly struggling to market their produce. Marketing of produce is thus generally a major constraint faced by farmers at the irrigation scheme.

The type of commodity markets accessed by the farmers determines the type of crops they grow. Most perishable commodities, such as green mealies, tomatoes, and cabbages, are sold to ‘bakkie’ traders. The ‘bakkie’ traders were the purchasers of the largest

volumes of these commodities. Most subsistence crops, on the other hand, such as cassava, bambara nuts and sweet potatoes, were sold to hawkers. With the exception of sugar beans, very few farmers sold their produce (especially their maize and cassava crops) locally.

The formal marketing channel (i.e. supermarkets such as Pick and Pay, and Spar) is the preserve of the very few that are able to produce specialized crops of good quality. These crops include chilies, butternuts and cabbages. The formal marketing channels are accessed through loose arrangements, on an individual basis and without formal contracts.

Chapter six focused on the agricultural support systems available for New Forest irrigation farmers and provided through both the government extension service and the New Forest irrigation cooperative. Agricultural extension services are essential for farmers, as they serve to link farmers with the authorities (the Department of Agriculture), resources, and information, and provide them with the capacity development needed to improve their productivity. Agricultural extension and advisory services have been viewed as militating against the positive impact of government agricultural development projects (DAFF 2011: 1). The current perceptions of agricultural extension by farmers in New Forest Irrigation Scheme are largely negative, as farmers feel that they are neglected. The support services expected by farmers from extension services are not effectively provided. There has also been a decline in the number of extension personnel serving farmers, and those in irrigation schemes in particular.

For extension to be effective, it should be able to mobilize the social capital of communities. This implies the coordination and grouping of farmers with similar circumstances to enable them either to benefit from synergies, or to make it easier for training and sharing of information. A long tradition of extension is group promotion and group organization (Rivera *et al* 2001:9). Given the large number of farmers to be served and the limited number of extension staff, extension cannot be effective when attempting

to engage with farmers as individuals. In the New Forest Irrigation Scheme, farmers need to be mobilized so that they are able to work as a unified group. This will entail sharing of common resources, such as water and tillage services, while also planning to grow the same crops at the same time so as to benefit from economies of scale through bulk inputs purchase and group marketing.

The irrigation cooperative provides a formalised and organised system to ensure that farmers are organised and effectively linked with input and outputs markets (Ortmann and King 2007a: 220). It should be seen as a vehicle to addressing some of these access issues, but not as an end in itself. For cooperatives to be effective in their 'vehicle' roles, they require to be empowered to operate in terms of the international cooperative principles. The role of the government should be significant, focused, coordinated, systematic and sustained over the long haul.

The New Forest irrigation cooperative is registered and has a constitution and by-laws that specify how it should operate. It has elected office bearers whose tenure is three years. Their role at the irrigation scheme is evident in their management of the three tractors available for providing tillage services to farmers. However, the cooperative is not involved in other activities such inputs procurement or marketing on behalf of the farmers. The current operation of the New Forest irrigation cooperative does not meet the expectations of the irrigators, leaving the farmers to operate as individuals in a system they could have benefitted from their association. Critical issues to be addressed include addressing cooperative governance issues, facilitation of farmer collective action, enforcing rules and regulations of engagement, and linking the irrigators more effectively with input and output markets.

Tillage is an important component of the farming system of smallholder irrigators in South Africa. In my entire sample of 94 irrigators, only two farmers use their cattle for tilling their land, and the rest rely on the three tractors provided by the irrigation cooperative. The Department of Agriculture, Forestry and Fisheries and the Department of Rural Development and Land Reform need to put their heads together to resolve the

tillage crisis that irrigation farmers face. It is unjustifiable to park 20 tractors for dry-land farming throughout the year and only release them to dry-land farmers during the rainy season, while irrigators need these tillage services throughout the year.

7.2 Implications of research findings for policy

7.2.1 Irrigation policy

Revitalization of smallholder irrigation schemes consists of rebuilding profitable farming enterprises on existing schemes and in the communities surrounding the schemes (Tapela 2014: 3; Denison and Manona 2007b: 4). Revitalization has been linked with Irrigation Management Transfers (IMTs) that consisted of transfer of the responsibility of managing, operating and maintaining irrigation schemes from the state to farmers (van Averbek and Mohamed 2006b: 6). Though this enabled the reduction in the government budget fiscus, essential services for smallholders were cut, and the farmers were not ready to take over the responsibilities of managing, and maintain the irrigation schemes.

It has been argued that investing in smallholder irrigation schemes is one of the most effective ways of developing smallholder agriculture and thus contributing to poverty alleviation (Machethe *et al* 2004:17). Irrigation development has been shown to benefit the rural poor in (1) increasing food production, (2) increasing on-farm and off-farm employment, and (3) income generation (Machethe *et al* 2004:17; Mwendera and Chilonda 2013: 68; Bembridge 2000:5).

Irrigation policy has to be developed in line with the livelihoods of smallholder farmers, and the diversity displayed in their farming styles. The key aspects of irrigation production, management and development discussed below for the New Forest Irrigation Scheme sheds further light on the need for more effective policy development and implementation.

7.2.2 Access to water

The main attraction of irrigation farming is access to adequate water for year-round farming and thus protection against the risks of unpredictable rainfall. South Africa is classified as a water-scarce country. It has insufficient water to meet its agricultural, domestic, industrial and environmental needs (Machethe *et al* 2004:19; Fanadzo 2012:1956). Machethe *et al* (2004:19) further argue that Mpumalanga and Limpopo provinces have reached the limit of formal irrigation, and so any additional areas in these two provinces can only be irrigated if water savings are made through more efficient methods in existing schemes. These studies show that given the scarcity of water, efficient usage of water in the existing schemes is essential.

Van Averbeke's (2012: 429) studies of irrigation schemes in the Vhembe district of Limpopo Province show that irrigation water availability was generally adequate, as only 5 of the 48 irrigation schemes reported year-round limitations. On 21 schemes, water availability was unlimited while seasonal limitations in availability were encountered mostly in canal schemes. On the other hand, Thabina irrigation scheme in Limpopo, Zanyokwe irrigation scheme in the Eastern Cape, and Tugela Ferry irrigation scheme and Msinga irrigation scheme in KwaZulu Natal had insufficient water for farmers' cropping needs (Veldwisch 2006: 5; Fanadzo 2012: 1959; Fanadzo *et al* 2010b; Tapela and Alcock 2011: 135). Many of the farmers interviewed at Thabina irrigation scheme, when asked to cite problems that they experienced at the scheme, said that water was the most prevalent problem (this was mentioned by 42% of the farmers) (Perret *et al* 2003:22). The findings at New Forest Irrigation Scheme similarly revealed concerns with water shortages, which result in conflicts between farmers and farmers often spending days, nights and weekends tending to the flow of water in order to prevent crop water stress. The water shortage situation at New Forest is compounded by neglect, as the government has never repaired the canals that channel water to the fields. This is the reason why the majority of plot holders have abandoned the fields.

The policy strategies that have been developed around access to water include water use authorization, water charges and water trading, and participation in water management through local organizations (van Averbeke and Mohamed 2006b: 13; Mohamed 2006:229; Perret 2001: 2). This study has shown that these policies have not been translated into action at the New Forest scheme. A total of 70% of the plot-holders are not actively farming and water conflicts are prevalent amongst the irrigators. The main dam and the reservoirs have silted up while the main canal and sub-canals are broken-down, without any repairs or maintenance being undertaken. It is essential for the government to provide funding for a major rehabilitation of the irrigation infrastructure, and also for routine maintenance. Regular maintenance and monitoring can initially be externally provided, with incorporation of the irrigation cooperative and the farmers over time so that the irrigators themselves can undertake future maintenance works.

Water user committees need to be established, which will be responsible for maintaining the water infrastructure, and regulating water usage by the irrigators. These would need support through training on their roles and secure the backing of irrigation cooperative structures so that they are able to enforce rules of co-operation.

7.2.3 Land tenure

Access to land within irrigation schemes in South Africa is mostly through PTO-holding, inheritance, informal leasing and share-cropping (Tapela and Alcock 2011: 134; Perret *et al* 2003: 14; Cousins 2013: 129). Van Averbeke (2012: 429) on the other hand, discovered that the most prevalent tenure system on smallholder irrigation schemes in Vhembe district was 'trust tenure'. This system was put in place when irrigation schemes were 'detrribalized' and transferred to the state. This system was noted to be the least secure of all types of tenure, and also resulted in the lack of land exchanges on the smallholder irrigation schemes in Vhembe (*ibid*). One factor that limits capital accumulation at Tugela Ferry Irrigation Scheme is the nature of the property regime in which informal land markets exist, but strong social sanctions limit the practice and thus constrain access to land by would-be accumulators (Cousins 2013: 134). The New Forest scheme has PTO-holding, inheritance, and informal leasing forms of land tenure. The

informal leasing type is the most insecure tenure type and this discourages investment in crop production. All the above studies concur on the insecurity of the informal leasehold tenure type, which is socially discouraged and thus practiced informally.

The majority of PTO-holders at New Forest irrigation scheme generally do not use their land, and not willing to lease it out to others. This observation is similar to the findings by Veldwisch, at Thabina irrigation scheme where leasing of land was very difficult as farmers not interested in farming continue to hold on to their land (Veldwisch 2006: 11). For those that do lease their land at New Forest, this appears not to be undertaken in good faith since it is leased only for very short periods of time. This unwillingness to lease fields for extended periods could be related to the fear of permanently losing their plots, as in the Msinga case (Tapela and Alcock 2011: 135). Tapela and Alcock (2011: 140) noted that short-term leasing of land to non-relatives is the preferred route taken by plot-holders to prevent complete loss of land and provide a safety net asset when needed in future. This could also be the reason that only limited land leasing is undertaken in the New Forest scheme. In-depth interviews with some of the active plot-holders (Kenny, Phineas, and Sam) showed that farmers actively utilized the irrigation scheme when they had either retired or were retrenched. It is necessary to interview inactive plot-holders to find out their reasons for not farming and their reluctance to borrow or hire out their plots to interested farmers.

The 30% of active farmers interviewed at New Forest Irrigation Scheme are generally in the 'tenants' category, which has insecure land tenure. These farmers need to be assisted to become more secure so that they can continue to invest in irrigation production and increase their output and productivity. Institutional support involving local leadership and extension staff should be considered in brokering negotiations on land leases between plot holders and tenants. Active farmers at the irrigation scheme illustrate the potential of the scheme for increased production. An analysis that compares both the overall gross margins and crop specific gross margins of profit makers, distinguishing between PTO-holders and tenants, did not reveal any significant differences between these tenure categories, meaning that type of land tenure arrangement does not directly impact on a

farmer's ability to make a higher profit, and demonstrates the comparative productivity of tenants.

7.2.4 Land preparation services

The land preparation activities implemented at the Tugela Ferry Irrigation Scheme utilized labour exchanges, payment of household and hired labour, donkey drawn ploughs, and tractors services at times (Tapela and Alcock 2011: 135). The tractor services were limited as the municipality had only few tractors for hire. At the New Forest scheme on the other hand, although the number of tractors were also low (only two in total), these were managed by the irrigation committee on behalf of the farmers. Livestock ownership was also limited amongst farmers. A study of six irrigation schemes in the Olifants River basin in Limpopo Province indicated that 92% of farmers hired private contractors for ploughing, disking and harrowing their fields (Machethe et al 2004: 32). As this proved to be expensive, most farmers abandoned their fields resulting in large tracts of unutilized plots at the scheme. All these studies on irrigation schemes reveal the importance of land preparation for crop production. The availability and affordability of tillage services is critical for continued and profitable crop production.

This study of New Forest Irrigation Scheme noted that only a few farmers (14%) own livestock, especially cattle that can be utilized for draught power. The low level of cattle ownership resulted from resettlement of the Xitsonga speaking people in New Forest village and without adequate grazing areas. The other livestock types owned cannot be used as draught animals. The use of livestock for draught power at the irrigation scheme is thus not a viable option, as it is in Msinga.

The New Forest farmers rely on tractor hire for ploughing, ridging and disking services. The three tractors owned by the irrigation cooperative provide these services. Notwithstanding frequent tractor breakdowns, the two tractors cannot be expected to adequately meet the tillage needs of the 150 active farmers on the irrigation scheme. The farmers mentioned that there are no private tractor service providers in the area. The

Department of Rural Development and Land Reform (DRDLR) has 20 tractors parked at the cooperative offices for usage during the rainy season, by farmers outside the irrigation scheme. The department has also had disagreements with service providers contracted to offer tillage services to farmers through these tractors.

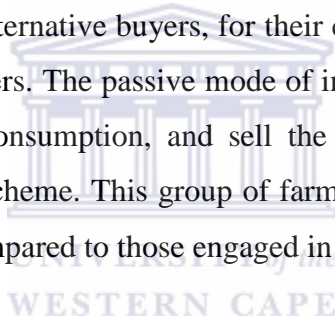
Although the financial support provided by government to the irrigation cooperative for maintenance of the tractors and payment of drivers is noted, more tractors are required for meeting the tillage needs of New Forest irrigators. The plan to transfer some tractors to the irrigation scheme by the DRDLR should be pursued. The contracting of future service providers for tractor services by the government should be transparent and involve the irrigation cooperative, since they are on the ground and can monitor the provided services. The service providers should thus be made accountable to the irrigation committee, which is the manager of services on behalf of the farmers. The irrigation committee could also assist the farmers by identifying private tractor service providers within the area who might be willing to hire out their tractors to farmers at negotiated rates. This should be considered as a complementary measure while the cooperative tractors continue to be the main service providers.

7.2.5 Marketing services

The major markets available to smallholder irrigators are informal marketing channels, which involve mostly ‘bakkie’ traders and street traders (van Averbeke *et al* 2011: 800; van Averbeke 2012: 433; Cousins 2013: 130). These studies show the limited marketing opportunities that smallholder irrigators have in South Africa. The formal marketing channels that link large-scale producers to processors or the four large supermarket chains are not easily accessible to smallholder farmers (van Averbeke *et al* 2011: 805; Cousins 2013: 135). This results in limited returns from crop production, competition for markets and gluts, as noted in Tugela Ferry (Fanadzo 2012: 1962; Cousins 2013: 135).

This study has shown that New Forest irrigators similarly rely on informal marketing channels for selling their produce. The major players include ‘bakkie’ traders and hawkers who purchase farmers’ produce directly from individual farmers in their fields.

This should be the starting point for developing more effective linkages to markets. The informal markets do not only dominate the irrigation scheme, but they are also easy to enter, and have lower transaction costs (transportation, packaging and processing) (Arias *et al* 2013: 18; Chikazunga 2013b: 20). As not all farmers are interested in marketing their produce, only those that desire higher cash incomes should be linked to markets. The informal markets serve the needs of ‘food farmers’ and ‘employers’ when they need an additional income from excess produce, while it enables ‘profit makers’ to earn an income from most of their produce. Two modes of farmers’ interaction with informal markets were noted, i.e. ‘active’ interaction and ‘passive’ interaction. Active interaction involves farmers planning what the market needs in advance of production, growing what the market needs, and phoning the buyers when the produce is ready for sale. The farmers that fall under this category need to be assisted with linkages to a greater number of buyers, as well as a range of alternative buyers, for their crops, perhaps developing niche crops required by specific buyers. The passive mode of interaction involves farmers who grow mostly for household consumption, and sell the excess produce to buyers that happen to visit the irrigation scheme. This group of farmers does not actively seek links with the market in advance compared to those engaged in active interaction.



The school feeding programme provides another marketing channel for the New Forest irrigators. Purchase price negotiations with farmers’ representatives and prompt payments are crucial to prevent dissatisfaction amongst farmers, as is expanding the programme to other schools in order to prevent market gluts. As farmers learn to produce the quantities and quality of produce required by schools, they can then begin to access the formal market system, such as supermarkets.

The formal markets should not be ignored, and a few farmers have already started participating in these markets. The ‘profit makers,’ are a category of farmers interested in diversifying their market sources to include formal markets. Through adopting a more homogeneous production system and engaging in collective action they could be assisted to supply formal markets such as Pick and Pay and Spar supermarkets that have a policy of purchasing some produce from smallholder farmers. The success of this initiative will

depend on their ability to be consistent in the relation to both quality and quantity of their produce.

7.2.6 Agricultural support services

Though various studies note that Irrigation Management Transfers led to the collapse of many irrigation schemes as government support was withdrawn, the irrigation scheme revitalization program (especially in Limpopo and Eastern Cape) provided funding for rehabilitation of some schemes (Cousins 2013: 126; Fanadzo 2012: 1959; Perret *et al* 2003: 17). This form of support, however, has generally been either inadequate or inappropriate. In some cases the focus has been solely on infrastructure rehabilitation, without any technical support in the form of farmer training or building institutional mechanisms for operating and maintaining the irrigation schemes. In other cases, irrigation schemes have been modernized with improved technology such as sprinkler valves and drip irrigation (van Averbek *et al* 2011: 799). This has made it difficult for smallholder farmers to operate and maintain the irrigation schemes. The New Forest scheme did not benefit from any government-led rehabilitation or revitalization programme to date. This has resulted in the gradual deterioration and breakdown of irrigation infrastructure.

The study of Tugela Ferry and Zanyokwe irrigation schemes by Fanadzo (2012: 1962) noted that very weak support services exist at the irrigation schemes. This has manifested in poor relationship between farmers and extension services, limited involvement of extension officers, and a lack of practical skills and know-how on the part of extension staff. Similar findings were noted at Zanyokwe irrigation and Thabina irrigation schemes (Fanadzo *et al* 2010a: 32; Perret *et al* 2003: 17).

The agricultural extension department and the irrigation cooperative are present at New Forest to provide support services to irrigation farmers; however, farmers are not pleased with the services provided. The Department of Agriculture Forestry and Fisheries (DAFF) has worked to profile their staff, capacitate them, and close the gap between the current personnel and the desired level (in relation to both numbers and 'quality') (DAFF

2009b: 3). However, a small share of New Forest farmers have received training and extension services from government, a pattern that is also noted for government programmes more widely by Aliber and Hall (2012: 551). Extension personnel need to offer farmers appropriate technical advice, such as what crops to grow, agronomic aspects, marketing, and irrigation scheduling. Further research and investigation is needed to ascertain what extension support and training is required from the perspective of smallholder irrigators.

The farmers at New Forest Irrigation Scheme do not operate as a unified collective in relation to activities such as purchase of crop inputs, water application, and marketing. The role of extension is to facilitate and mobilize farmers to be organised and work together, thus enabling them to build their social capital. This is not happening at the moment at the New Forest scheme, and this is similar to the findings of Mnkeni *et al* (2010:327), who report that Tugela Ferry and Zanyokwe irrigation schemes have weak organizational and institutional arrangements that affect their productivity and overall performance. The recommendation is therefore to strengthen farmer organization and institutional arrangements at New Forest Irrigation Scheme. The irrigation cooperative needs to be empowered and take up its leadership role at the scheme. This empowerment should cascade down to the farmers' ward-level committees. The institutional rules (both underlying norms and formal rules) need to be examined, updated and shared with farmers and enforced to ensure that governance is clear and formalised.

From the farmers' perspective, the irrigation cooperative is present on paper and only visible in relation to management of the three tractors provided by the DAFF. Weaknesses of the irrigation cooperative include inadequate skills and knowledge of their role, and lack of external cooperation. As training has never been provided to the New Forest irrigation cooperative on their roles, this needs to be prioritized. Training needs to be provided continuously as the cooperative committee is changed every three years. The irrigation cooperative needs to be linked with other cooperatives and development structures beyond the local extension officers so that they are exposed to new information and opportunities for smallholder farmers. The development of strong apex organizations

for irrigation farmers in Mpumalanga would help the locally embedded New Forest irrigation cooperative to enter into the mainstream of provincial-level farming development. This would enable them to access services and resources such as finance, marketing and advisory services that are available in the province and nationally.

Farmers feel that the cooperative should be able to provide inputs in bulk at the warehouse for purchase by the irrigators. This would enable standardization (type and quality) of the crops grown, and enable farmers to purchase inputs closer to home, and more cheaply as a result of bulk discounts. As a substantial market for inputs exists at New Forest irrigation, private agricultural supply companies should establish branches at Thulamahashi shopping mall so that farm inputs are accessed nearby.

7.2.7 Farming styles and livelihood trajectories

The diversity of farming styles and livelihood trajectories shown by New Forest irrigation farmers has implications for national policies for assisting smallholder farmers, and irrigation farmers in particular. Smallholder farmers are not only a diverse and heterogeneous population, but also change their farming styles over time depending on their circumstances.

‘Food farmers’ with the objective of supplementing their household consumption needs tend to be conservative and may not be willing to take the risks associated with commercial production. It should not be assumed that they are willing to engage in commercial production. These farmers need to be supported to improve food production, as they are oriented towards household consumption. It is necessary to improve production and yields through better agronomic practices and access to adequate water and inputs. To improve household level food access, these farmers need support with food processing and storage facilities for their produce (Mohamed 2006: 232). This farmer group underscores the fact that not all farmers engaged in crop production at irrigation schemes have the sole objective of getting an income. These findings agree with Tapela’s study in Limpopo irrigation schemes where she proposed that for ‘food

producers' it was critical to subsidize their livelihoods and social safety nets in order to achieve broader policy objectives regarding poverty and social integration (Tapela 2014:27).

The 'employers' farming style lies between the extremes of risk aversion and risk taking, depending on their circumstances. These farmers are cautious in pursuing activities that will result in them incurring higher costs. Diversification by 'employers' into other, less risky livelihood activities on-farm and off-farm is an option for them. This could include poultry production, and petty trading such as buying and selling. The gross margins for 'employers' show that not all smallholder irrigation farmers are able to make a profit, and that other, less risky alternative livelihood options need to be considered.

Those farmers who are 'profit makers', on the other hand, are more willing to embrace risky activities that might result in them increasing their profits. Access to inputs, water, and alternative markets would result in them increasing their profits, further investment in irrigation production, and increased wealth. These findings show that some smallholder farmers are able to be productive and earn high profits from farming. They need assistance to continue to improve their productivity and linkages with alternative markets (both informal and formal).

As these farming styles and livelihood trajectories are dynamic, farmers are expected to migrate from one farming style to another depending on their individual circumstances and access to resources. Constant interaction and consultations with farmers is thus critical to ensure that support provided to them is relevant for their farming objectives and livelihood aspirations. The correlation between farming style and livelihoods shows that the farming style pursued by farmers has an impact on the livelihood development trajectory that they are likely to follow.

7.3 Conclusion

In conclusion, I have argued that smallholder farmers are diverse in terms of their resource endowments, farming objectives, farming styles and livelihood trajectories.

Irrigation schemes do provide opportunities for smallholder farmers to meet their food needs, improve their incomes and reduce their poverty. The notion of investing in smallholder irrigation schemes in order to convert smallholders into commercial farmers is unrealistic. The development objectives of smallholders are diverse, and any assistance should be provided in the context of this diversity. Those who can be classified as ‘food farmers’, benefit from irrigation development and participation through meeting their household consumption needs. This should be the basis of determination of what crops they are assisted to grow, what agronomic skills they require, and what level of market participation is relevant for them.

Those who can be classified as ‘employers’, grow mostly cash crops as well as a few subsistence crops, and hire most farm labour, and full-time workers in particular. On average these farmers obtained negative gross margins per plot. These farmers are cautious in pursuing activities that would result in them incurring high costs. Diversification by employers into other less risky livelihood activities on-farm and off-farm is an option. This could include small stock production (poultry, or piggery production) or buying and selling. Those farmers who can be classified as ‘profit makers’ make high returns from crop production, and obtain the highest gross margins per plot. Irrigation income contributes about 75% of their household income. Access to inputs, water, and alternative markets would result in them maximizing their profits, investing further in irrigation production, and increasing their wealth. These farmers have the potential to develop into market-oriented smallholders in tight value chains or small capitalist commercial farmers (Cousins and Chikazunga 2013).

Agricultural support to smallholder farming is necessary if smallholder farmers are to reap the benefits of increased productivity, more food for domestic consumption and higher incomes. The role of the government through extension services should be significant, systematic, focused, coordinated, and sustained over the long haul. The irrigation cooperative requires revamping to make it useful, relevant and accessible to irrigators. The New Forest Irrigation Scheme has been neglected by the government of South Africa for a long time compared to the other irrigation schemes studied by other

scholars in the Eastern Cape, KwaZulu-Natal and Limpopo provinces. This study was able to show that despite this neglect, the active farmers have been able to reap positive rewards from irrigation production such as supplementary food and cash incomes, though the latter are low for most farmers. Even greater returns from irrigation production would be realized and sustained if the government played its role of rehabilitating the dilapidated irrigation infrastructure, and providing the tillage and extension services required by the farmers. The level of irrigation scheme land utilization would also increase above the current 30%.

Collective action by smallholder farmers is a cross cutting theme, and is crucial for the farmers to be able to purchase inputs, engage in co-operative marketing, and manage and maintain the irrigation scheme. It was noted that there were no initiatives to collectively access input and output markets at the New Forest scheme. The farming world is very competitive, in both informal and formal agricultural value chains. The irrigation cooperative should provide a formalised and organised system to ensure that farmers are organised and well linked with input and output markets. The role of extension should be to mobilize the social capital of smallholder farmers around issues of common interest such as water management, farmer training, sourcing inputs, and commodity marketing.

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Appendix 1: Household Questionnaire

Household Interview guide

Questionnaire number					
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Name of respondent	
Area	
Section	
Name and surname by which homestead is known	
Cell phone number of respondent	

Particulars of visit to the homestead

Particulars of visits	Date	Time started	Time ended
First visit			
Second visit			
Third visit			

Hello, my name is I am. I am conducting a study of.... Your homestead has been selected for participation in this survey. We ask permission to interview the main farmer from this homestead. The selected farmer's participation is voluntary i.e. he or she has the right to refuse. The information obtained from all participating farmers will be compiled in a report and the findings will be presented to people in the surveyed areas. No names will be referred to in the report. Your responses will be kept strictly confidential.

Do you have any questions before we start? **IF NO, CONTINUE WITH THE INTERVIEW.**

Table 1: Homestead members

Please tell me about all the people who are members of the homestead, even if they are not here at the moment. Do not include people who have established other homesteads and have not come home in the last few years. Include only those that live here most of the time/nights [USE CODES TABLE 1: Homestead members]

Household head: Start with household head first on row 1 below.

Name	Sex	Year of birth	Relationship	Marital status	How often is this person present at the homestead?

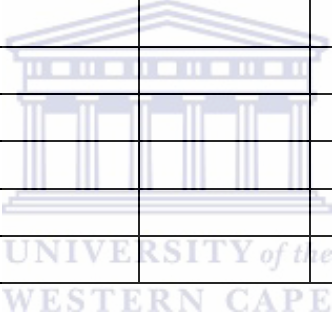


Table 2a: Sources of Income of Homestead members

Full name	Income source 1	Amount	Income source 2	Amount	Income source 3	Amount

*Indicate whether received per month or per year

Table 2b: Sources of Income of Homestead members

Full name	Income source 4	Amount	Income source 5	Amount	Income source 6	Amount

* Indicate whether received per month or per year

Ranking of sources of income of homestead members

Please rank the four most important income sources of the homestead, in order of importance, and explain why each is so important.

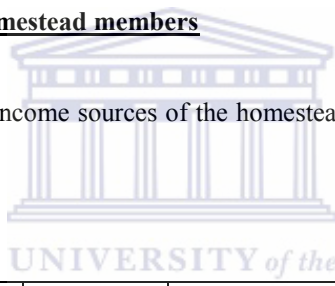


Table 3: Income source ranking

Rank order	Income source	Cash (R)	Unit (Month=1; Year=2)	Reasons for importance
1				
2				
3				
4				

Table 4: Durable goods and productive assets of homestead members

Domestic	Does homestead have		Number owned	Total
	Yes	No		
1 Electric stove				
2 Microwave				
3 Sewing or knitting machine				
4 Washing machine				
5 Lounge suite				
6 Gas stove				
7 Paraffin stove				
8 Fridge/freezer				
Electronic/Communication				Communication
9 Radio				
10 CD player				
11 TV/DVD player				
12 Computer				
Transport				Transport
13 Motor cycle				
14 Bicycle				
15 Vehicle				
Agriculture				Agriculture
16 Tractor				
17 Plough				
18 Wheelbarrow				
19 Knapsack sprayer				
20 Animal drawn cart				
21 Garden spade				
22 Garden fork				
23 Hoe				
24 Other (specify)				

Land use by members of the homestead last year

Table 5: What types of land does this homestead have? (Including land that is not adjacent to the homestead)

Type of land	Has the land been used in the last 12 months?		Year land first acquired	How land first acquired	Number of blocks owned	Number of blocks borrowed	Size of land
	Yes	No					
Residential							
Garden plot within homestead							
Fields							
Irrigation scheme plot							
Project garden plot							
Additional land (specify)							



If land is owned but not used, please explain why:

From your irrigation plot, how many times did you plant last year? This year?.....

If you planted less than 3 times in a year, what are the reasons?

.....

.....

.....

.....

Crops grown by members of the homestead last year

Table 6a: What types of crops were grown on the land used by this homestead last year?

Type of land	Crop type 1	Amount harvested	Crop type 2	Amount harvested	Crop type 3	Amount harvested
Garden plot within homestead						
Fields						
Irrigation scheme plot						
Project garden plot						
Additional land (specify)						



Table 6b: What types of crops were grown on the land used by this homestead last year?

Type of land	Crop type 4	Amount harvested	Crop type 5	Amount harvested	Crop type 6	Amount harvested
Garden plot within homestead						
Fields						
Irrigation scheme plot						
Project garden plot						
Additional land (specify)						

Table 7: Crops sold by members of the homestead last year

Crop type	Amount sold	Measure	Cash received	Purchaser

Table 8: Livestock owned by members of the homestead

Type of livestock	Number owned now	Purchases in last year	Sales in last year	Births in past year	Deaths in last year	Slaughtered in last year
Cattle						
Goats						
Sheep						
Donkeys						
Pigs						
Chickens						
Other						

Table 9: Livestock sold by members of the homestead last year

Livestock type	Number sold	Cash received	Purchaser
Cattle			
Goats			
Sheep			
Donkeys			
Pigs			
Chickens			
Other			

Appendix 2: New Forest Irrigation Scheme: Crop Recording Sheet

Date: **Farmer:** **Block No:**

No. of plots in farmer's own name ("owned"): **No. of additional plots** (rented or borrowed):

Rented or borrowed from whom? In return for:

Crop (eg tomatoes): **Variety** (eg Florodade, Heinz 1370)

Area planted to crop: metres x metres = m² (Crop spacing: cm x cm)

Date planted .../.../.... **Date of first harvest** .../.../.... **Date of final harvest** .../.../....

Did you disk the plot Yes/No If yes, for how much? R.....

How the plot was **ploughed** (eg. hoe, donkeys, tractor)? Cost: R

Chemical fertilizers applied before planting:

Name/type	Amount in kg	Cost

Chemical fertilizers used as **top dressing**:

Name/type	Amount in kg	Cost

Seeds: were seeds kept from last year or purchased?

If purchased, amount in grams: Where purchased? Cost: R

Seedlings: number purchased: Where purchased? Cost: R.....

Chemicals used to control pests and diseases:

Pest or disease	Name of chemical	Amount (grams/kg) purchased	Cost	Amount applied on this crop

Labour: how many people worked on this crop?

<i>Operation</i>	<i>Family labour</i>	<i>Hired labour</i>	<i>Payment / cost in R</i>
Clearing the plot			
Ploughing			
Weeding			
Watering			
Spraying			
Harvesting			
Marketing			
Other operations			

Yields and marketing (NB: the unit of measurement will vary by crop e.g. crates, buckets, kg, bags, etc).

	Number	Measure (eg bags, buckets, etc)
Used in farmer's home		
Given to others as gifts		
Used to pay workers		
Sales for cash		
Stored		

If sales took place, to whom was the crop sold?

	Number	Measure	Price per measure	Amount received
Directly to consumers				
To hawkers				
To traders with bakkies				
To shops				
Others				

Marketing costs

Costs	Number	Unit/measure used	Costs
Travel			
Materials (e.g. bags)			
Other (specify)			

Calculating the gross margin:

Costs:

Disking		Gross margin (profit) is income less total costs (A - B = C)	A. Income from crop	
Ploughing			B. Costs	
Fertilizers			C. Gross margin	
Seeds				
Chemicals				
Labour				
Marketing				
Other				
<i>Total</i>				

Appendix 3: Focus Group Discussion Guide – Irrigation cooperative committee

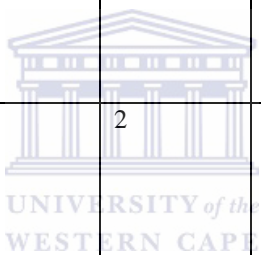
1. How and when was this cooperative formed?
2. What is its legal status? Do you have a constitution, by-laws?
3. Who are the members of this cooperative and roles/positions?
4. Does the cooperative have a committee, and who is part of the committee and their roles?
5. Whom does this cooperative report to/answerable and what are the modalities thereof?
6. What is the role of this cooperative?
7. What are some of the ways you have supported farmers in the scheme during the last season?
8. What are the farmers expected to pay to the cooperative for which services?
9. How is the cooperative maintained/funded so as to fulfill its role?
10. Which platforms are used to interact/communicate with farmers, e.g. meetings, field days, etc
11. What farm equipment does the cooperative have at its disposal, and when and who purchased it?
12. What challenges have you faced in the last 3 years as the cooperative, and how were they resolved?
13. What are some of the successes has the cooperative registered in the last 3 years?

Thank you

Appendix 5: Family History Characteristics

Variable	Kenny	Mary	Angela	Thabie	Derick	Allan	Phineas	Sam	Janet	Rose	Musa
Household size	10	4	7	4	7	8	10	8	4	6	4
Irrigation Section	New Forest	New Forest	New Forest	Tsuvulani	Tsuvulani	Tsuvulani	Demulani	Demulani	Edenburg	Edenburg	Edenburg
Sex of household head	Male	Male	Female	Female	Male	Male	Male	Male	Female	Male	Male
Marital status	Married	Married	Single parent	Divorced	Married	Married	Married	Widower	Single parent	Married	Married
Total number income sources	3	2	2	3	3	3	5	2	3	2	1
Types of income sources	Farming ; Pension (x2)	Farming; formal employment	Farming; child grant	Farming; poultry; petty trading	Farming; child grant (x2)	Farming; child grant (x2)	Farming; child grant (x4)	Farming; pension	Farming; child grant; pension	Farming; pension	Farming; formal employment
Number of child grants received	0	0	1	0	2	2	4	0	1	0	0

Variable	Kenny	Mary	Angela	Thabie	Derick	Allan	Phineas	Sam	Janet	Rose	Musa
Number of pensions received	2	0	0	0	0	0	0	1	1	1	0
Size of plots owned	Unkno wn	1.4ha	Unknow n	1.2ha	1ha	0ha	1.4ha	1.2ha	1.3ha	0ha	1.4ha
Size of plots accessed	Unkno wn	1.4ha	Unknow n	1.2ha	1ha	1ha	2.6 ha	1.2ha	1.3ha	1.2ha	1.4ha
Number of times planted last year	2	2	2	2	2	2	2	2	2	2	2
Number of times planted this year	3	2	2	2	2	2	2	2	1	2	2
Number of crops grown last year (2012-	2	3	1	4	5	2	4	2	4	4	3



Variable	Kenny	Mary	Angela	Thabie	Derick	Allan	Phineas	Sam	Janet	Rose	Musa
2013)											
Types of crops grown last year (2012-2013)	Maize, Cabbage	Maize, spinach, sweet potato	Maize	Maize, butternut, beetroot, tomatoes	Maize, butternut, spinach, cabbage, chilies	Maize, tomatoes	Maize, tomatoes, cabbage, groundnuts	Maize, tomatoes	Maize, groundnuts, Bambara, sweet potato	Maize, groundnuts, Bambara, sweet potato	Maize, tomatoes, butternuts
Overall crops gross margin	-R2,660 Loss	R19,050 Profit	-R6,320 Loss	R19,811 Profit	R17,125 Profit	R14,585 Profit	R3,416 Profit	R1305 Profit	R1,920 Profit	R1,375 Profit	-R8,265 Loss
Maize gross margin	R1,190 Profit	R15,680 Profit	-R6,320 Loss	R7,765 Profit	-R2,033 Loss	R3,610 Profit	R4,155 Profit	R65 Profit	R450 profit	R265 Profit	-R3,510 Loss
Groundnut gross margin	N/A	N/A	N/A	N/A	N/A	N/A	R600 Profit	N/A	R1,100 Profit	R540 Profit	N/A
Tomato gross margin	N/A	N/A	N/A	R5,850 Profit	N/A	R10,975 Profit	-R238 Loss	R1,240 Profit	N/A	N/A	-R1,445 Loss