# THE ROLE OF AGRICULTURAL EXTENSION IN PROMOTING FOOD SECURITY IN THE CONTEXT OF ENCOURAGING BIODIVERSITY CONSERVATION IN SOUTH AFRICA: THE CASE OF KWAZULU-NATAL

by

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# ABSTRACT

This study evaluates the roles of agricultural extension relative to overcoming household food security and biodiversity conservation concerns in South Africa, with specific reference to the KwaZulu-Natal province. Food security in South Africa is paradoxical. The country is nationally food secure, yet a sizable percentage of its households remain hungry. The national government identifies agriculture as a potentially viable vehicle to ensure food security among the poor households. On the other hand, agricultural activities have taken a centre stage among the identified major drivers for biodiversity loss in the country. In fact, it is as if the relationship between agriculture, being the driver for food security, and loss of biodiversity is 'inversely proportional'; hence the efforts to attain household food security and to ensure biodiversity conservation appear to be mutually exclusive. Extension is particularly well positioned to address both food security and biodiversity conservation concerns, since its activities are directly related to both objectives. In this context, this study investigates and unravels the functions which extension currently plays in respect of achieving these two seemingly contradictory objectives within KwaZulu-Natal, and draws conclusions about what must be done to effectively position agricultural extension to realise these currently dichotomised objectives simultaneously in the country.

The research processes adopted for this investigation are two-fold: a theoretical and philosophical process, on the one hand, and an empirical process, on the other. Both processes followed a systematic investigation pattern. The influence of extension on food security and biodiversity conservation respectively were first interrogated separately; and subsequently, its influence on both of them simultaneously was examined. Drawing on relevant published works, in the case of the theoretical process, this study was able to establish that extension is particularly well positioned to address both food security and biodiversity conservation concerns simultaneously through the instruments of linkages, local knowledge facilitation, engaging and building on social capital and education.

The empirical process involved data collection through semi-structured interviews with respondents, comprising various national and provincial-level food security and extension managers and extension practitioners, as well as food security/extension officers from two NGOs and farmers. A total of 46 respondents participated in the investigation on food security and extension issues, and 44 respondents were interrogated on biodiversity conservation and extension issues. Some of the participants were engaged for both investigations.

The study generally found that extension engages primarily in technology transfer and supply of farming inputs like seeds and fertilizers to the farming households. Three sets of factors affecting the capacity of extension to promote food security together with biodiversity conservation emerged: household/community-level factors; social factors; service delivery factors; and ecological factors; the last being specifically related to biodiversity conservation promotion. Key among these factors were: inadequate household production resources including lack of seed banks and poor education, inadequate involvement of youth and men in agriculture, ecological conditions consisting of irregular and inadequate rainfall, drought and flooding, the top-down nature of agricultural and extension interventions, poor collaboration and coordination between extension and biodiversity conservation institutions, and poor extension management and delivery capacities.

The study concluded on the need for appropriate linkages between the extension and the food security and biodiversity directorates of the Provincial Department of Agriculture, strengthening extension support system, and creating an atmosphere conducive to extension activities. It recommends that efforts of government, extension management, food security and biodiversity conservation institutions and farmers be integrated and better coordinated to clearly articulate policies for extension, food security and biodiversity conservation.

In the light of the conclusions, the study developed and presented a ‘Refurbished Extension Model’ which builds on the current South African model by introducing the following three elements:

i. collaboration among all the stakeholders involved in promoting food security, biodiversity conservation and agricultural extension objectives;
ii. adoption of capacity-building approach (replacing the current top-down, technology transfer approach) by extension to support farmers who are at the centre of the food security and biodiversity objectives; and
iii. re-invigoration of extension institutions by providing specific capacities which are lacking at present within the institution.

With these in place, the model postulates that extension, alongside farmers, would be better placed to foster new farming ideologies to address the food security and biodiversity conservation concerns simultaneously.

Keywords: agricultural extension, food security, biodiversity conservation, KwaZulu-Natal, South Africa

# PREFACE

This study took place between January 2011 and September 2013, with the cooperation of the University of KwaZulu-Natal, School of Agricultural, Earth and Environmental Sciences, Agricultural Extension and Resource Management Programme and the research participants- both governmental and non-governmental- that are involved in food security, biodiversity conservation and agricultural extension initiatives in South Africa.

The thesis was written and compiled under the supervision of my erudite supervisor, Dr Steven Hugh Worth, who is also the coordinator for the Agricultural Extension and Resource Management Programme at the University of KwaZulu-Natal. Except where references have been indicated, this thesis presents the original research study by the author, and has not been submitted in any form to another institution of learning for the purpose of any degree award.

……...

Abdu-Raheem, K.A. (Candidate)

……..

Worth, S.H. (Supervisor)

# DEDICATION

This thesis is dedicated to

ALLAH, the ALMIGHTY, WHO in HIS mercy,

Has granted me all it takes to undergo this demanding work.

My LORD challenges mankind repeatedly in the Qur'an- chapter 55-, noting:

"*Which then of the bounties of your Lord will you deny?*"

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| AIDS | Acquired Immuno Deficiency Syndrome |
| CARA | Conservation of Agricultural Resources Act |
| EKZNW | Ezemvelo KwaZulu-Natal Wildlife |
| FAO | Food and Agricultural Organisation |
| HIV | Human Immunodeficiency Virus |
| HSRC | Human Sciences Research Council |
| IFSS | Integrated Food Security Strategy |
| INS | Integrated Nutrition Strategy |
| IAASTD | International Assessment of Agricultural Knowledge, Science and Technology for Development |
| IPGRI | International Plant Genetic Resources Institute |
| IUCN | International Union for Conservation of Nature |
| KZN | KwaZulu-Natal |
| MDGs | Millennium Development Goals |
| MEA | Millennium Ecosystem Assessment |
| NDA | National Department of Agriculture |
| DAFF | National Department of Agriculture, Forestry and Fisheries |
| NAMC | National Agricultural Marketing Council |
| NSBA | National Spatial Biodiversity Agency |
| NGOs | Non-Governmental Organisations |
| PAs | Protected Areas |

| | |
|---|---|
| SCBD | Secretariat of the Convention on Biological Diversity |
| UNICEF | United Nations Children's Fund |
| UNCTAD | United Nations Conference on Trade and Development |
| UNDP | United Nations Development Programme |
| USD | United States Dollar |
| WBFPW | World Bank Food Price Watch |
| WPC | World Parks Congress |

*CHAPTER ONE*

# GENERAL INTRODUCTION

## Background to the study

Mitigating the threats facing nearly a quarter of the global wild animal species and the significant agro-biodiversity presents a difficult and daunting task especially in relation to seeking solutions to the plight of some 800 million and 1.2 billion people suffering from under-nourishment and abject poverty (McNeely &Sherr, 2002). Environmental sustainability and food security are two major goals in the Millennium Development Goals (MDGs). Food and nutrition securities feature in Target 2 of Goal 1, which seeks to: "Halve the proportion of people who suffer from hunger", while biodiversity conservation features in Target 7, aiming to: "Ensure environmental sustainability" (United Nations, 2005:4). Alleviating worldwide food insecurity without compromising natural biodiversity resources remains an elusive objective and, therefore, necessitates further research.

The Food and Agricultural Organisation (FAO) and the International Plant Genetic Resources Institute (IPGRI) are two international institutions leading research focused on achieving food security in the context of biodiversity conservation. They have created a concept of biodiversity for food and nutrition. The general aim of this concept is to design and implement plans of action relating to food and nutrition securities while, at the same time, encouraging sustainable uses of biodiversity resources. Through this, they highlight the importance of biodiversity and the role it has to play in achieving sustainable development (Esquinas-Alcazar, 2005).

In addition, the food-insecure and extremely poor populations reside in countries with the largest biodiversity resources. This suggests that the efforts geared towards solving problems of food security and biodiversity conservation should not be in isolation to each other (World Summit on Sustainable

Development, 2002; United Nations Division for Sustainable Development, 1992). While food security is an issue of concern in all developing countries, it is of particular concern in Africa where it is severe. One major underlining factor for this food shortage severally reported in literature is that, the per capita food production in Africa shows a growth decline, while showing an increase for other developing countries (FAO, 1996).

In South Africa, food security can be viewed at the levels of nation and household. As a nation, according to National Food Security indicators, South Africa is food secure. In fact, South Africa has been nationally food secure for more than twenty years. It excels in the production of some varieties of agricultural food products in which it has comparative advantages, such as maize and potatoes. The country exports surpluses from such products, and imports those it lacks or produces inadequately; all contributing to meeting its national food requirements. However, at the household level, South Africa is not universally food secure. Some 14.3 million South Africans (about 35% of the total population) are not food secure (Hirschowitz, 2000). Many of these people are largely dependent on the natural resources available to them for livelihoods. They often use these resources unsustainably. In this context, the South African government has expressed its desire to ensure that food security is achieved at the household level (Altman, Hart & Jacobs; 2009), without compromising the country's conservation objectives (Botha, 2004).

In terms of biodiversity wealth, South Africa is blessed and has several Protected Areas (PAs) covering about 6% of the national territory. The country is recognized as one of the 17 "mega diversity" nations of the world. Although South Africa covers 2% of the global land area, it is a home to not less than 10% of the total world's plants and 7% each of the world's mammals, reptiles and birds. However, notwithstanding the extent of PAs in the country, these do not adequately cover the full range of biodiversity types requiring conservation. For example, out of 441 vegetation types found in the country, 110 are not situated in PAs at all. In addition, 90 vegetation types have less than 5% of their geographical area for biodiversity conservation protected, and more than 300 vegetation types

have less than half of their biodiversity conservation target protected within statutory PAs (Botha, 2004). Therefore, the South African government has emphasized the need to expand biodiversity conservation PAs within the boundaries of the nation.

The food and conservation needs of South Africa outlined above underscores the urgent need to explore solutions to fulfilling both household-level food security and farm-level conservation objectives simultaneously. This exploration is the focus of this research. It is aimed at identifying the roles that agricultural extension could play in helping the nation to achieve its aim of household level food security while, at the same time, not compromising the biodiversity conservation concerns of the country.

## Research Question

The research conducted in this thesis was driven by the following central question: How can South African public agricultural extension effectively promote food security in the context of encouraging biodiversity conservation? This primary research question gave rise to the following secondary questions:

a. What is food security?
b. What is biodiversity conservation?
c. What is the role of agricultural extension in promoting food security?
d. What is the role of agricultural extension in promoting biodiversity conservation?
e. What is the role of agricultural extension in simultaneously promoting food security and biodiversity conservation?
f. What factors limit/affect the capacity of agricultural extension in simultaneously promoting food security and biodiversity conservation?

## Research Objectives

In the context of agricultural extension, the objectives of this study were:

- To establish the potential synergies between promoting food security and biodiversity conservation.
- To identify or develop workable strategies and methods for the simultaneous promotion of food security and biodiversity.
- To identify and develop responses to constraints and barriers (including training and operational issues) limiting agricultural extension in the simultaneous promotion of food security and biodiversity conservation.

## Theoretical framework

With increasing global-scale campaigns to both enhance food security and reduce biodiversity loss, it is counterproductive to seek solutions to either of the two, to the exclusion of the other. Agriculture undoubtedly serves a meeting point for both objectives. Domestic livestock grazing dominates about 40% of the total global land, while intensive and extensive agricultural uses account for 10% and 17% respectively (Woo, Sebastian & Scherr, 2000; Mooney, Copper & Reid, 2005). These agricultural uses have a range of associated ecological footprints (Scherr & McNeely, 2008) and thus, have an impact on biodiversity conservation. Furthermore, notwithstanding the *status quo*, land uses for agriculture may likely increase with time due to increasing demands for food stemming from the prediction that the current global human population is projected to increase to 7.2 billion, 8.3 billion and 9.3 billion by the years 2015, 2030 and 2050, respectively (Cohen, 2003; FAO, 2003). In addition, between 80-90% of inhabited lands by humans are put to productive use, and over 1.1 billion people, with most being dependent on agriculture, reside within the locations of the 25 globally identified biodiversity hot spots (Cincotta & Engelman, 2000; Myers, Mittermeier, Mittermeier, Da Fonseca & Kent , 2002). All of these amply demonstrate both the

convergence of agriculture and biodiversity conservation, and the need for these two aspects of global life to be addressed concurrently and coherently.

The contribution that agricultural extension has made or can make to synchronise both food security and conservation objectives is rarely discussed and remains inadequately explored. Although agricultural extension primarily focuses on enhancing agricultural production and improving rural livelihoods, particularly through smallholder farmers, international anticipations somehow require and compel a re-evaluation and modification of agricultural extension objectives to suit the current global development and sustainability concerns.

The theoretical framework for this work thus consists of three facets: *food security, biodiversity conservation,* and *agricultural extension.* Unlike previous works that have sought to study these variables in isolation of one another, this study makes use of an interdependency approach: that food security, biodiversity conservation and agricultural extension are all linked to one another.

Smallholder farmers are critical stakeholders and role-players in the effort to achieve both food security and biodiversity conservation, particularly in developing countries. This is because the 500 million smallholder farmers in the developing world, with their families, approximate one-third of the global population. However, the success of these smallholder food producers depends greatly on increased productivities of land and other natural resources, market integration, technological innovation, human resource capital and social capital development (Thapa, 2009).

Integrating all the factors to address food security without compromising biodiversity conservation constitutes a herculean task. This study, however, hypothesises agricultural extension to be a viable vehicle towards achieving both objectives. Therefore, this work studies the role of agricultural extension in South Africa relative to these objectives by establishing the potential synergies between promoting food security and biodiversity conservation, identifying or otherwise developing workable strategies and methods for the simultaneous promotion of food security and biodiversity and, finally, by identifying and developing

responses to constraints and barriers (including training and operational issues) which limit agricultural extension in the simultaneous promotion of food security and biodiversity conservation.

## Methodology

The study employed a qualitative approach. Qualitative research is the umbrella term used for a wide range of approaches like interpretive and constructivist approaches to research (Nieuwenhuis, 2007a:50). Qualitative research thus uses a naturalistic approach that seeks to understand phenomena in context-specific settings, such as "real world settings where the researcher does not attempt to manipulate the phenomenon of interest" (Merriam & Associates, 2002:4; Cresswell, 2007:37).

Research design is governed by the notion of the fitness of purpose. The purpose of the research determines the methodology and the design of the research. It is also "an action plan for getting from here to there, where 'here' is the initial set of questions and 'there' is the set of answers" (Cohen, Manion &Morrison, 2007:78). A case study research design was employed to determine the possible linkages that exist between food security and biodiversity conservation and to understand the influences which agricultural extension has on both of them. Case study research is particularly useful "especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003: 13). In addition, case study research is a systematic inquiry into an event or a set of related events which aims to describe and explain the phenomenon of interest in a social setting to enable the researcher to understand how it operates or functions (Nieuwenhuis, 2007a:75). Qualitative research uses a case study research design connoting that the data analysis focuses on one phenomenon which the researcher selects to understand in depth, regardless of the number of sites or participants for the study (McMillan & Schumacher, 2001: 398). Case studies offer a multi-perspective analysis in which the researcher considers not just the voice of one or two participants in a situation, but also the views of other

relevant groups of actors and the interaction between them (Nieuwenhuis, 2007a:75).

## Research area and sampling

The study was conducted primarily in KwaZulu-Natal, South Africa. It included interviews and surveys among extension practitioners and relevant officials in government and NGOs who are engaged in food security and biodiversity issues. Some farmers and national agencies were also included in the study.

Sampling refers to the process used to select a portion of the population for study (Nieuwenhuis, 2007a:5), in order to make conclusions about the whole population (Zikmund, 2000:338). As stated by Cresswell (2007:37), qualitative researchers tend to collect data in the site where participants experience the issue or problem under study.

Purposive sampling was used to select public officials relevant to extension provision and those involved in food security and biodiversity conservation initiatives at both the provincial and national levels, as well as in NGOs. In purposive sampling, researchers hand-pick the cases to be included in the sample based on their judgment of their typicality or the possession of the particular characteristics being sought; that is, they build on a sample that is satisfactory to their specific need (Cohen *et. al.*, 2007:254). Purposive sampling is used to increase the utility of the information obtained from small samples (Schumacher & McMillan, 2001:401).

Field-level extension agents and farmers were selected through convenience sampling which allows the researcher to select cases that are most accessible for a sample, haphazardly. This is most appropriate particularly when the population is relatively homogenous, a factor that compensates significantly for the possible biases that would have made generalisation for the whole population less reliable (Saunders, Lewis & Thornhill, 2007). Convenience

sampling is also suitable when choosing cases that are readily available and willing to participate at the time of data gathering (Onwuegbuzie & Leech, 2007). The sample size was dependent on the principle of saturation, when no further information and insights were derived from additional interviews (Glasser & Strauss, 1967).

## Data gathering methods

The data in a case study research can be derived from six major sources; interviews, documents, archival records, direct observation, participant observation and physical artefacts (Yin, 2003:13). A blend of data gathering techniques was used for obtaining data for this study. These included:

**Literature review:** Literature reviewing is "a process of reading some background information that has been published and appears to be relevant to the research topic" (Bless & Higson-Smith, 1995:22). Primary and secondary data relevant to the study were critically examined, evaluated and objectively recorded to achieve the purpose of this study. The literature was used to identify and develop indicators that were used for the interviews and the document analysis.

**Interviews (Semi-structured):** An interview is an interchange of views between two or more people on a topic of mutual interest. It allows participants – be they interviewers or interviewees - to discuss their interpretations of the world in which they live, and to express how they regard situations from their own point of view (Cohen *et. al.,* 2007:349). Semi-structured interviews contain a mix of more or less structured questions in which specific information is desired from the participants, and the largest part of the interview is guided by questions or issues to be explored (Merriam & Associates, 2002:12). An interview comes in handy as the main instrument to obtain first-hand and in-depth information. In this study, interviews were conducted with the research participants covering issues relating to biodiversity, food security challenges and the influences of agricultural extension on both.

**Document Analysis:** Documentary information is seen as a major source of evidence used in case studies (Merriam & Associates, 2002:12). The strengths of documents as a data source lies with the fact that they already exist in the situation and do not intrude upon or alter the settings in ways that the presence of the investigator might be influenced. Nor are they dependent upon the whims of human beings whose cooperation is essential for collecting data via interviews and observation, for example (Merriam & Associates, 2002:13). In this study, documents from relevant government departments were critically reviewed to extract information describing and explaining the condition of biodiversity and food security in KwaZulu-Natal, and what the influences of the public agricultural extension are on enhancing the achievement of both the food security targets and biodiversity conservation goals.

**Research validity and Trustworthiness:** Triangulation was used to determine points of similarities and differences in qualitative data collected from participants through interviews, observations and document analysis, thereby improving the study through enhancing the credibility of findings and interpretations.

**Data Analysis:** The data analysis involved qualitative approaches such as content analysis and inductive coding that is aimed at examining meaningful and symbolic content of qualitative data (Nieuwenhuis, 2007b:99). Using this approach assisted in determining the relationships between emerging themes/patterns through qualitative inferences which were identified, and also in discussing the similarities and differences that corroborate or contradict the findings used in this study. In addition, the contents of the interviews, field notes and documents were reviewed and coded to identify the emerging concepts, constructs and themes. They were subsequently analysed according to their themes and recurring patterns of meanings and relationships (Cohen *et al.*, 2007:489).

## Expected outcomes

Four key outcomes are expected from this study. They are to:

i. develop a workable model for the simultaneous promotion of food security and biodiversity;
ii. propose a new concept for extension, applying the principles of Sustainable Livelihood;
iii. identify and develop responses to constraints and barriers (including training and operational issues) limiting agricultural extension in the simultaneous promotion of food security and biodiversity conservation; and
iv. provide the relevant Departments of Agriculture managing the South African public Agricultural Extension with an objective model of potential synergies in achieving food security and biodiversity conservation concurrently.

## Significance of the project

Achieving household food security in the context of sustainable natural resource management has not been possible for the South African government. This study suggests that Agricultural Extension can facilitate the realization of this objective if an appropriate approach to extension is developed in alignment with the current trend of global and national agricultural and environmental development goals, and if it is properly aligned and integrated with the policies, processes and systems that govern food security and bio-diversity initiatives. The level of poverty and lack of progress, as admitted by the South African Government in its agricultural strategy (National Department of Agriculture [NDA] 2005), is a clear indication of the failure of Agricultural Extension to contribute meaningfully to the transformation agenda in agriculture. However, contemporary global concerns about natural ecosystems management further pose challenges to Agricultural Extension practitioners whose primary aim is to promote agricultural and rural development. This study, therefore, creates a

model that integrates objectives of achieving food security and biodiversity conservation simultaneously and sustainably, without which the livelihoods of hundreds of thousands of rural smallholder farmers in KwaZulu-Natal are at stake.

This study further provides the State with a theoretical framework for assessing the current Agricultural Extension and Agricultural Extension models, and makes recommendations for necessary changes. Beyond this, it provides a deeper understanding of the role that Agricultural Extension can play in fulfilling the aims and objectives of national agricultural strategy, and proffers a foundation for reviewing Agricultural Extension itself. It provides for the integration of Agricultural Extension with natural resource management objectives of the State. The proposed changes to Agricultural Extension as a practice are fundamental and somewhat sweeping in nature. It is evident that, without such changes, rural livelihoods will continue to deteriorate and the lofty objectives of the promulgated agricultural policy will not will not be attainable. Thus, this study hopes to make a meaningful contribution to addressing this vital aspect of sustainable development in South Africa.

## Limitations and delimitations of the study

This section highlights the limitations and delimitations of this study. The limitations include:

i. Generalizability of the findings and conclusions:

   The study, apart from collecting data from the national offices related to food security, agricultural extension and biodiversity conservation, only sampled relevant stakeholders from the KZN province. This makes the findings and the generated conclusions specifically more relevant to the KZN province, and may not necessarily be readily generalizable to the other provinces of South Africa.

ii. Details of extension workers' competency:

The study did not investigate the details of the technical competency needs of extension workers relative to delivering on food security and biodiversity objectives simultaneously, which may have enhanced the value of this study. While the researcher prepared and administered questionnaires for this interrogation, he experienced a particularly low return rate of the questionnaires and incomplete responses among some of those that were returned. This made it impossible to have enough sample questionnaires for purposes of analysis sufficient for a rigorous scientific inquiry regarding the subject. This factor was compounded by the financial constraints of the study and the limited time to ensure that this aspect of the investigation was carried out more thoroughly. Hence, this line of investigation is excluded in this study with the hope that this much-needed research will be carried out in the near future.

The delimitations in this study include:

i. Low number of sampled farmers:

From the onset, the study was premised on carrying out its investigation only from the perspectives of the extension service providers. Although farmers are critical participants in the extension conversation, they are sparingly sampled only to validate the information gathered from the public extension workers and the general extension providers. On this basis, the study did not consider interviewing as many farmers as would have been required if farmer perceptions were the focus of the study.

ii. Unexhausted interrogation of food security components:

While Chapter 2 acknowledges clearly that food security is not just about food availability and its accessibility, but also the derivation of essential nutritional values from food, the trend of investigation in this study largely considered only the food availability and access aspects of food security. This was deliberate as the researcher was aware that the public delivery

related to ensuring rural households' acquaintance with nutritional values and essential combinations of foods is not within the mandate of the public extension service in South Africa, but rests with the Food Security division of the National Department of Agriculture, Forestry and Fisheries (DAFF). Interrogating public extension workers on this aspect would have been unproductive.

iii. Extension Policy

This study was specifically focused on investigating the roles of extension in enhancing household food security and biodiversity conservation concurrently. While it could be worthwhile to thoroughly interrogate the compatibility of the various specific components of the national policy for extension with the objectives of enhancing food security and biodiversity conservation, it was not exclusively the aim of this study.

**Thesis presentation**

This thesis is comprised of seven chapters in addition to this introductory chapter. Chapters 2 – 7 are presented as journal articles while Chapter 8 is presented in the form of a summary and discussion. The published papers are presented in their entirety as published, thus there is some unavoidable repetition of information and overlaps of themes. The chapters are presented as follows:

Chapter 2: A philosophical, peer-reviewed journal article entitled, 'Household Food Security in South Africa: Evaluating Extension's Paradigms Relative to the Current Food Security and Development Goals', which investigates the possible roles that extension can play in enhancing household food security. This paper was published in the *South African Journal of Agricultural Extension* [Vol. 39(2), 2011: 91 –103].

Chapter 3: A philosophical, peer-reviewed journal paper entitled, 'Agricultural Extension in the Facilitation of Biodiversity Conservation in South

Africa', which considers how extension can influence biodiversity conservation on farms. This paper was published in the *South African Journal of Agricultural Extension* [Vol. 40, 2012: 36 – 47].

Chapter 4: A philosophical, peer-reviewed journal paper entitled, 'Food Security and Biodiversity Conservation in the Context of Sustainable Agriculture: The Role of Agricultural Extension'. This paper discusses how extension can simultaneously promote household food security objectives within the context of enhancing biodiversity conservation. This paper was published in the *South African Journal of Agricultural Extension* [Vol. 41 (1), 2013: 1 – 17] and is currently in press.

Chapter 5: A paper entitled, 'Exploring the Roles of Agricultural Extension in Promoting Food Security in KwaZulu-Natal Province, South Africa', that interrogates the current roles played by extension in promoting household food security in the KwaZulu-Natal province and the limiting barriers to extension's effectiveness. This paper is submitted and currently under review for publication in the *International Journal of Agricultural Sustainability*.

Chapter 6: A paper entitled, 'Exploring the Roles of Agricultural Extension in Promoting Biodiversity Conservation in KwaZulu-Natal Province, South Africa', which explores the influences of extension on biodiversity conservation among rural farming households and identifies factors militating against the success of extension. This paper is submitted and currently under review for publication in the *Agroecology and Sustainable Food Systems* journal.

Chapter 7: A paper entitled, 'A Model to Integrate Simultaneous Promotion of Food Security and Biodiversity Conservation through the Activities of Agricultural Extension'. Based on Chapters 5 and 6, this paper examines the current structural conditions within which extension is expected to promote food security and biodiversity conservation. Thereafter, it proposes solutions to the shortcomings found therein through a 'Refurbished Extension Model'.

Chapter 8: This chapter provides a general discussion and conclusion based on the previous chapters, with suggestions for future research.

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*CHAPTER 2*

# HOUSEHOLD FOOD SECURITY IN SOUTH AFRICA: EVALUATING EXTENSION'S PARADIGMS RELATIVE TO THE CURRENT FOOD SECURITY AND DEVELOPMENT GOALS

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## Abstract

Food insecurity is still a great concern for many households in South Africa. This situation is connected to the high level of poverty that exists in the country, particularly in rural areas. Rural households use five key pathways to address their food insecurity and poverty: an agricultural path; a multiple-activity path; an assistance path; a micro-enterprise path and an exit path. Using this framework of pathways, this paper presents a philosophical argument exploring the role that agricultural extension can play in helping to realise the goals of food security and poverty alleviation in rural South African households. Drawing on relevant published works, this paper argues that extension is particularly well positioned to address food insecurity and poverty through the instruments of technology transfer and innovation, human capital development, social capital development and increasing market access. These instruments were found to be capable of influencing the full range of pathways when applied through the agricultural path.

Keywords: Agricultural extension, household, food security, South Africa

## Introduction

Establishing food security, particularly household food security, is widely acknowledged as an important milestone in advancing the living standards of the rural poor. One avenue toward realizing this is through small-scale agriculture, which can be fostered through appropriate agricultural extension. However, food security programmes and extension approaches and agendas are often not compatible. Food security has about 200 definitions (Hoddinott, 2001). This study, however, makes use of the definition given in the State of Food Insecurity 2010 report by the Food and Agricultural Organization (FAO), which states: "food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2010:8).

Although, globally, sufficient food is produced to make it possible to achieve food security (Islam, 1995), the number of undernourished people in the world has increased from about 840 million in 1996 (FAO, 1996) to about 925 million in 2010 (FAO, 2010), with 98% living in developing countries (FAO, 2010). The United Nations Children's Fund (UNICEF) indicates that at least 150 million children are undernourished, 32 million of whom live in Africa (UNICEF, 2001). This demonstrates that producing sufficient food globally does not necessarily imply equitable and proportionate distribution among people. Similarly, sufficient food production nationally may also not translate to food security at the household level, as is the case in South Africa (van der Berg, 2006). It can also occur that a household has sufficient food, but it is inequitably distributed within the household (Hyder, Maman, Nyoni, Khasuanu, Teoh, Premji & Sohani, 2005).

Many factors contribute to food insecurity at the household level: political instability, civil friction and wars, macroeconomic imbalances, environmental degradation, poverty, increased population, gender discrimination, poor health and illiteracy (Smith, El Obeid & Jensen, 2000) . These factors may be categorized as follows:

(a) Insufficient food availability at the national level, resulting in food insecurity at the household level;

(b) Insufficient household food production or lack of economic power to purchase food; and

(c) Inequitable intra-household access to food.

Poverty, which falls into the second category, is strongly correlated with food insecurity (Barrett, 2010). Therefore, it is necessary to address poverty and food security simultaneously, and it will be of value to establish how agricultural extension can contribute to simultaneously alleviating poverty and achieving food security. This paper will explore this question by discussing South Africa's food security condition; food security as a public and an economic good; pathways for households to exit poverty and food insecurity; agricultural extension in relation to achieving food security and agricultural extension paradigms. The paper will finally suggest ways to achieve this dual objective by synthesizing and combining the objectives of public agricultural extension with the food security and development targets.

## South Africa's food security condition

South Africa produces enough food to feed its population, but experiences rapidly increasing rates of household food insecurity (van der Berg, 2006). Although employment has risen in the country, it has not attained the level where it can significantly address the issue of income poverty (Aliber, 2009). Furthermore, while the national government provides social grants which help to minimize the rate and effect of food insecurity within the country, 40-50% of South Africans live in poverty (Machethe, 2004, citing Terreblanche, 2002). Approximately, 35% of the total South African population – about 14.3 million people - experience hunger and under-nutrition (Rose & Charlton, 2002), the majority being children, women and the elderly.

Recently, prices of wheat and maize, which form part of the staple foods in South Africa, have increased in world markets (Heady & Fan, 2008). This development worsens the food insecurity condition as households now face further difficulties in procuring food items from their earnings. The FAO (2009) notes that landless and female-headed households, together with both the rural and urban poor, constitute the major groups most affected; meaning that this situation is likely to persist over the next decade (Heady & Fan, 2008).

Other factors contributing to the food insecurity situation of South African households include increases in the cost of electricity and oil prices. The electricity price is set to increase by 100% between 2008 and 2011. Regular increases in the oil price result in higher prices for food items and fertilizer, the production of which petroleum forms an indispensable input. The cost of transportation also increases, forcing food prices to increase proportionately (Altman, Hart & Jacobs, 2009).

In 2008, an estimated 39.26% of the total South African population lived in rural areas (World Bank, 2010). Further to this, 65% of those identified as "poor" and 78% of those identified as "chronically poor" reside in rural environments (Woolard & Leibbrandt, 2002). These statistics suggest that interventions to combat food insecurity in South Africa should be largely directed at rural communities.

Smallholder agriculture is a major tool for creating employment, for human welfare and for ensuring political stability in sub-Saharan Africa, particularly in rural areas (Delgado, 1998). Furthermore, small-scale agricultural production helps reduce rural poverty and food insecurity (Lele & Agarwal, 1989). South Africa is no exception to this experience. It has been reported that of the total household income in rural South African households, smallholder farming constitutes the greatest single source of that income; it accounts for over 40% of the total household income (Machethe, Mollel, Ayisi, Mashatola, Anim & Vanasche, 2004). Other sources of income identified by Machethe *et al.* (2004) were non-farm income, including pension remittances, wages, profit from family businesses and income from other sources, each of which was less than 40% of

the total household income. Given that, worldwide, most poor people live in rural areas and that agriculture is their main source of livelihood, focusing on factors that will enhance smallholder agriculture should bring about a lasting solution to the problems of rural poverty and food insecurity (Lopez, 2002).

## Food security as a public and an economic good

According to Paarlberg (2002), public goods refer to goods that are non-excludable, and which do not dwindle due to consumption. He argues that the supply of public goods is a responsibility of any government to its people. Although food security is not a public good because it is excludable and can dwindle, it should be treated as a public good by the state. Paarlberg (2002: 13) asserts:

> "In the area of food security, one such good might be a supply of cheap food made available to the poor through a public food distribution system. In other cases, the pursuit of food security might even require that private goods (such as land) be taken from a traditionally privileged category of citizens, with or without compensation, for redistribution to disadvantaged citizens. In still other cases, food security might require government action to reduce racial prejudice or gender inequity."

Furthermore, Diouf (2002) argues that the voluntary signing of the World Food Summit Pledge by the UN member states' governments, agreeing to halve the current food insecurity rate, is an indication of their full acknowledgement that food security should be treated as a public good and that all governments must address food insecurity. The implication is clear: the importance of the government in ensuring food security to its citizens cannot be over-emphasized.

Considering food security as an economic good, agricultural economists Johnston and Kilby (1975) and Eicher and Staatz (1984) reported that aggregate economic output and employment rates grow more quickly when development interventions are concentrated on peasant and small-scale farmers. Conversely,

some social scientists argue that service delivery, mainly aimed at increasing production by small-scale poor producers in remote locations, will only result in low yields and declining results (Farrington, Christoplos, Kidd & Beckman, 2002; Berdegué & Escobar, 2002).

The South African government has applied various strategies to address poverty and food insecurity within the country. It has used social grants and, over decades, has established a number of institutions and programmes focusing on food security, including the National Nutrition Council (established in the 1940s), the National Nutrition and Social Development Programme (established in 1990), the Community Based Nutrition Programme, and the Primary School Nutrition Programme (both established in 1994). Addressing broader issues in food security, the Integrated Nutrition Strategy (INS), also established in 1994, focused on land reform, agricultural credit provision, infrastructure development and comprehensive farmer support as tools to enhance agricultural production (Bonti-Ankomah, 2001). However, the INS has not made any appreciable progress in the area of comprehensive farmer support (Machethe, 2004). Machethe (2004) further indicates that the South African government needs to give more support to the extension sector as the primary source of support to small-scale farmers to improve agricultural production, especially at the rural household level.

## Pathways explored by rural households to address food insecurity and poverty

Finding a pathway out of food insecurity and poverty requires a multidimensional approach (World Bank, 2000)**.** De Janvry and Sadoulet (2001: 9-10) identify four pathways which households use to address their food insecurity and poverty: an "agricultural path"; a "multiple-activity path"; an "assistance path"; and an "exit path". In addition, Haggblade, Hazel and Reardon (2002: 39) identify a fifth path, a "micro-enterprise path".

***Agricultural path:*** This pathway refers to using agricultural production by the rural poor who have access to land and other farming resources. However, a

challenge to the long-term usefulness of this path is a prediction made by Cour, Club and Snrech (1998) that people following this path are likely to be marginalised in the future by commercial farmers who are able to apply technologies and marketing systems that current developments demand. This path has constituted the focus of integrated rural development interventions for some time now, and has met with mixed success due to difficulties in the adoption of existing rural development packages by rural communities (World Bank, 1997).

***Multiple-activity path:*** This pathway refers to rural households using off-farm income sources as their main means of livelihood, with agricultural production being secondary. Households in this path often use off-farm income to finance their farming activities. They are caught between two limited income sources. While these households have land, they are not strategically located to access markets, limiting income from farming. Off-farm job opportunities are also limited, restricting off-farm income. They must use both income sources in order to survive (De Janvry & Sadoulet, 2001). Furthermore, López and Valdés (2000) note that the income earned by households in this path is lower, on average, compared to that of those who rely completely on off-farm sources of income.

***Assistance path:*** This pathway refers to extremely poor households that depend on transfers (e.g. remittances from a family member working away from home) as their primary source of income. It includes households without other resources for which remittances are their permanent source of income and households that have other resources but, due to immediate circumstances, use remittances as a temporary income source and as a safety net, protecting them from having to sell off their productive assets. Such households use this pathway to prevent themselves from losing their assets and thereby degenerating from their transient poverty condition into perpetual poverty (De Janvry & Sadoulet, 2001).

***Exit path:*** This pathway refers to the situation in which rural poor migrate from their rural environment to urban centres, for the express purpose of escaping poverty. Although this seldom features in the discussion of agricultural and rural development, it has been identified as a means which is frequently used by rural families to cope with poverty and food insecurity (De Janvry & Sadoulet, 2001).

Rivera (2004, quoting Berdegué, 2003), argues that the significance of this pathway should not be underestimated in that remissions made by migrants in Latin America amount to several billion US dollars per year. Contrarily, O'Hare and Rivas (2007) argue that migrations mostly result in engendering transfers of poverty to urban centres – urbanisation of poverty in the wording of the UN-Habitat (2003) – and the erosion of rural human resources (the educated and young adults), rather than alleviating poverty conditions. Further to this, O'Hare and Rivas (2007) indicate that rural-urban migration may likely plunge the ordinary poor in rural communities into extreme poverty, due to diminution of the human resource base.

***Micro-enterprise path***: This path refers to the situation in which rural poor own and manage businesses for a livelihood, which are sometimes related to agriculture. These businesses often include merchandise and food shops, processing services and storage facilities (Haggblade *et al*., 2002). Rivera (2004) indicates that people using this path are often better off those who are solely reliant on agriculture. Orr and Orr (2002) indicate that the establishment of an individual or a family micro-enterprise is important for the poor to earn an income.

Critically analysing these paths, it is apparent that 'income generation' is central and common to all five pathways and that, agriculture is a major consideration for rural households in deciding how to escape poverty and food insecurity. Agriculture remains an income source in the first two and the micro-enterprise pathways and thus, efforts can be made to further strengthen this as a viable income source. Given that the households in the latter pathways are in rural areas, it is suggested that small-scale agriculture be explored as a means to diversify incomes for these households. This would allow them to overcome dependence on remittances and avoid the need to leave the rural area, thereby creating additional options to overcoming poverty and food insecurity.

## Agricultural extension's role in achieving food security

There is no single and specific definition of agricultural extension. Extension as a term was first employed in the description of some adult education programmes being run by the universities of Cambridge and Oxford in England in 1867. The main aim of these programmes was to extend research outputs of the universities beyond their boundaries into the surrounding communities (Jones & Garforth, 1997). Furthermore, Jones and Garforth (1997) state that the effort to disseminate and campaign for the use of improved agricultural systems and management methods dates back several decades to different locations in the world. However, prior to being named as such, the beginning of public extension or advisory systems dated back to before 1867, with the United Kingdom and Ireland as the pioneers. Between 1845 and 1851, when Ireland was experiencing a potato famine, it was the public agricultural advisors who came to the rescue of potato farmers by assisting them to diversify production into different agricultural crops. Following this development, European and North American governments institutionalised the services of 'travelling instructors' in the second half of the 19$^{th}$ century.

## Agricultural extension paradigms

To understand what role agricultural extension can play in addressing South African rural household food security concerns, it is useful to consider the general objectives and approaches of agricultural extension. Swanson (2009) identified four categories or models of agricultural extension: technology transfer; advisory services; non-formal education and facilitation extension. Groot and Roling (1998) described a similar range of extension approaches. Worth (2006) suggests a fifth approach: facilitated learning. Table 1 provides a brief comparison of four of these approaches using eight critical factors: purpose, assumptions, source of innovation, promoter's role, farmers' role, supply/demand, orientation and target.

**Table 1:** Comparison of Extension Approaches

| Characteristics | EXTENSION MODELS/APPROACHES | | | |
|---|---|---|---|---|
| | **Linear** | **Advisory** | **Facilitation** | **Learning** |
| **Purpose** | Production increase through transfer of technology<br><br>Government policy | Holistic approach to farm entrepreneurship | Empowerment and ownership | Awakening desire and building skills in learning for advancement as jointly defined by partners |
| **Source of Innovation** | Outside innovations | Outside innovations and by farm manager | Local knowledge and innovations | Synergistic partnership of farmers, researchers and extension |
| **Promoter's Role** | Extending knowledge | Providing advice | Facilitating | Promoting learning skills and facilitating partnerships for learning |
| **Farmer's Role** | Passive: others know what is best<br><br>Adopting recommended technologies | Active: problem solving<br><br>Asking for advice<br><br>Taking management decisions | Active: problem solving; owns the process<br><br>Learning by doing<br><br>Farmer-to-farmer learning | Considering all possibilities<br><br>Contributing to own and others' learning; partner in learning |
| **Assumptions** | Research corresponds to farmer's problem | Farmer knows what advisory services he needs | Farmer willing to learn to interact and to take ownership | Farmer less powerful in learning relationship; needs support in developing desire and skill to learn |
| **Supply/ Demand** | Supply | Demand | Demand | Supply to evoke dynamic relationship of supply and demand |
| **Orientation** | Technology | Client | Process | Client and process and 'right' placement of technology |
| **'Target'** | Individuals<br><br>Farmer organisations<br><br>Projects | Individuals<br><br>Groups with common problems | Groups and organisations, interaction of stakeholders, networking | Farmers in context of a learning partnership<br><br>Others in partnership in context of facilitated learning |

Derived from Blum (2007) and Worth (2006); and adapted by Abdu-Raheem and Worth.

## Synthesis of the objectives of public agricultural extension with food security and development targets

As South Africa becomes more conscious of the need to combat household food insecurity and rural poverty, extension emerges as a potentially powerful vehicle to achieve this. This is evidenced by the many meeting points between the objectives of agricultural extension, food security and poverty alleviation. Extension can make it possible for rural farming populations to integrate sustainable natural resource management and viable agricultural production with their food production systems. Figure 1 provides insight into how this is possible.

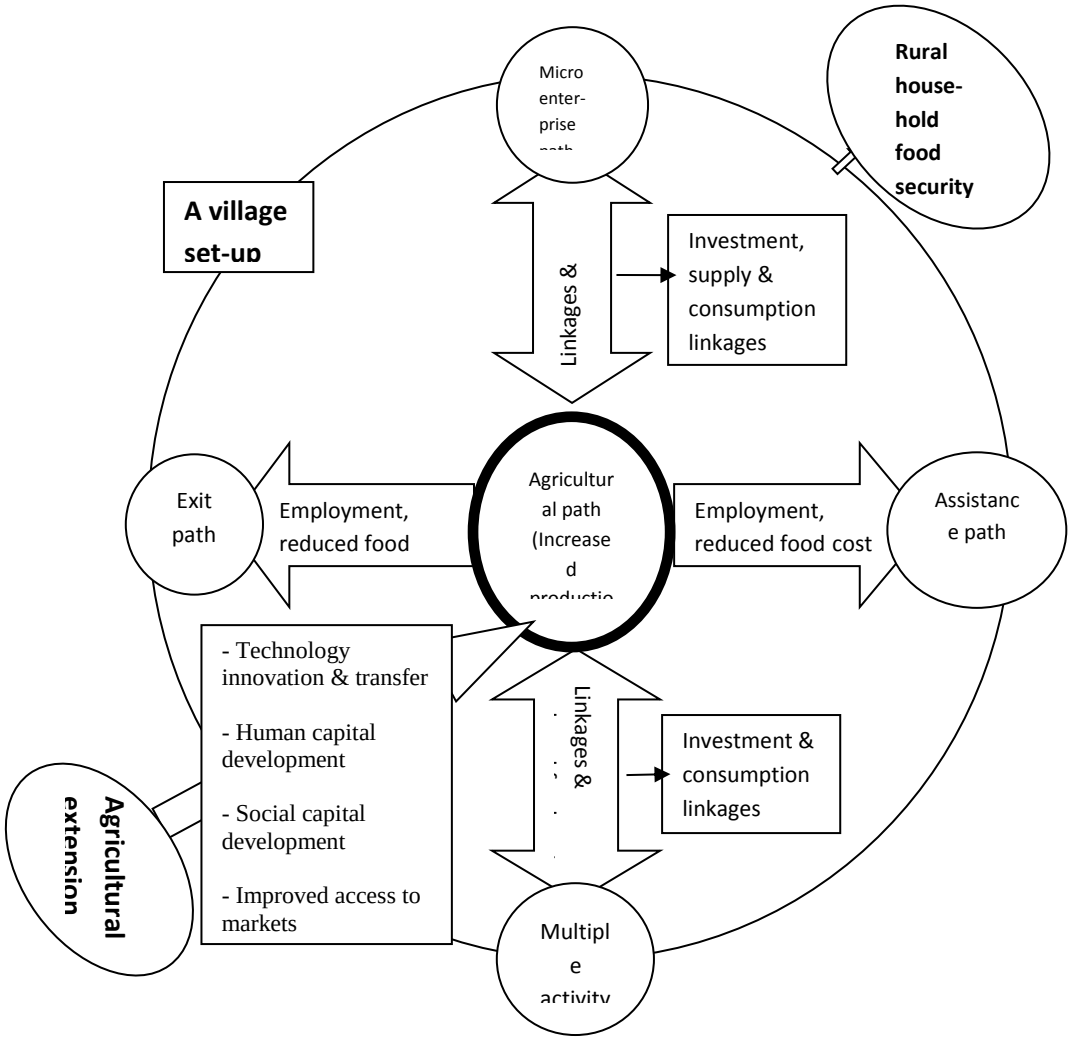


**Figure 1**: The potential influence of agricultural extension on rural household strategies to address poverty and food insecurity.

Figure 1 illustrates how agricultural extension influences rural household food security and poverty alleviation strategies through the agricultural path strategy. Its chief instruments of influence are technology innovation and transfer, human capital development, social capital development and access to markets.

Figure 1 further illustrates that the introduction and innovation of agricultural technologies has direct and indirect effects on reducing household poverty. The major direct effect is that technologies lead to increased production for personal household consumption and profits for farmers (de Janvry & Sadoulet, 2002). De Janvry and Sadoulet (2002) further argue that new technologies lead to higher yields and to reduced production costs, which translate into higher profits. The indirect impacts of new technologies are reduced food prices (resulting from higher agricultural productivity and output), employment creation for households in the exit and assistance paths and general economic growth (through investment, supply and consumption linkages), particularly for households using off-farm sources of income, as in the multi-activity and micro-enterprise paths (Berdegué & Escobar, 2002).

Technology innovation and transfer in agriculture is a useful strategy, particularly in South Africa where revival of small-scale agriculture has been identified as a potential solution to the problem of involuntary unemployment (Klasen & Woolard, 2008). Farm jobs are created through the increased need for planting, weeding, manure/fertilizer application, harvesting and other production related activities. In Ethiopia for example, Berhe, Dessalegn, Baredo, Teka, Hoekstra and Tegegne (2009) note that nursery operations are able to exploit the opportunity afforded by limited supplies of planting materials, resulting in creating employment opportunities for the landless youth and individual male and female farmers; and also providing its operators with a significant income of between 100 and 11,000 USD per season. Off-farm employment opportunities will arise from “down-stream” post-harvest value-adding activities, such as agro-processing, storing, packaging and distribution. In addition, technology innovation and transfer can lead to increased labour wages (Berdegué & Escobar, 2002).

Furthermore, new technologies in agriculture stimulate linkages between farm and off-farm income sources (Reardon, Berdegué & Escobar, 2001), which consequently result in general economic growth. This is particularly important for those who utilise the multi-activity and micro-enterprise paths for a livelihood. Agricultural growth creates a demand linkage for rural off-farm investments by advancing their demand capacities for production inputs and consumption commodities. A supply linkage is created when growth in agriculture provokes off-farm investments' capacities in supplying inputs and services to the agricultural sector. An investment linkage, however, is created when people in the multi-activity and micro-enterprise paths are enticed to diversify their income base by investing in agriculture, given its sudden boom with high returns and increased profits in off-farm businesses, while those in the farming business act in the opposite manner, for similar reasons (Reardon *et al*., 2001; Berdegué & Escobar, 2002).

These direct and indirect effects of technology innovation and transfer are not automatic. They are influenced by a number of factors, including how early or late farming households adopt innovations, tradability of the products in question and whether the majority of households in the market are net-buyers or net-sellers (Berdegué & Escobar, 2002). Similarly, De Janvry and Sadoulet (2000) note that, a key factor in exploiting employment potential is to educate rural youth for off-farm employment.

As shown in Figure 1, extension develops human capital. Developing knowledge and skills among farmers is one of the primary functions of extension. Depending on the area of extension focus, human capacity is built in a variety of areas, including agricultural production, farm management, marketing and natural resource management (Swanson, 2006). Such human capacity developments benefit households in whatever exit path they are using.

The final two of extension's instruments of influence which are shown in Figure 1 – developing social capital and improving market access – are closely interlinked. Extension builds social capital among rural farmers by assisting them to form "bonds" among themselves (e.g. farmers' associations) and "bridges"

linking them to post-harvest operations and markets (Swanson, 2006). This will help them to reduce production costs and improve their profit margin through their strengthened bargaining powers in both input and output markets. Also, alliances between farming households bring about better articulation of their needs from extension officers, research bodies and other agricultural institutions (Swanson, 2006). In order to sustain such social capital, particular attention should be given to organising rural youth (Pretty & Hine, 2001).

## Conclusion

This paper has highlighted various means by which agricultural extension can help address food security and poverty at the household level. Its chief instruments of technology innovation and transfer, human capital development, social capital development and increasing market access are effective means of addressing food insecurity and poverty at the household level. The paper demonstrates that, by focusing on enhancing agricultural productivity and profitability (through the agricultural path option), all the other options available to rural households can also be enhanced. Thus, it is vital that agriculture remains an integral part of any government's strategy to address food insecurity and poverty at the household level. Whatever approach or combination of approaches are used – technology transfer, advisory, facilitation, or learning – agricultural extension programmes should be re-examined and adjusted so that they are made to contribute to creating and maintaining food security and to alleviating poverty at the household level.

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*CHAPTER 3*

# AGRICULTURAL EXTENSION IN THE FACILITATION OF BIODIVERSITY CONSERVATION IN SOUTH AFRICA

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## Abstract

Biodiversity conservation, particularly on communal and rural farmlands, is still of great concern in South Africa. This worry is further worsened by the different threats that communities pose to biodiversity resources on their lands, ranging from deforestation and habitat fragmentation, to encroachment, pollution, invasion of alien species, wild fires, logging and hunting. Agriculture emerges as the greatest factor posing the most threats to biodiversity. Using this framework of interconnectedness between biodiversity and agriculture, this paper presents a philosophical argument exploring the role that agricultural extension can play in the realisation of the goals of biodiversity conservation on South African communal and farm lands. Drawing on relevant published works, this paper argues that extension is particularly well positioned to address biodiversity conservation concerns through the instruments of social mobilization, education, indigenous knowledge facilitation, linkages and on-going advisory services.

Keywords: Agricultural extension, Biodiversity conservation, South Africa

## Introduction

The importance of extending biodiversity conservation beyond the boundaries of the officially designated Protected Areas (PAs) has recently been recognized (Scoones, Melnyk & Pretty, 1992; Halladay & Gilmour, 1995; Mc Neely, 1995). This thinking stems partly from the fact that PAs currently do not provide sufficient representations of the important biodiversity components that are worth being conserved (Margules & Pressey, 2000; Pressey, Wish, Barret & Watts, 2002; Rodrigues, Andelman & Bakarr *et al.*, 2004; Chape, Harrison, Spalding & Lysenko, 2005), and partly because of threats posed to biodiversity from both within and outside PAs (Hilton-Taylor, 2000). Establishing the urgent need for intervention, Hilton-Taylor indicates that some 25% of all mammals, 12% of birds, and 20-30% of reptiles and amphibians are currently endangered.

Dissecting the threats faced by biodiversity in PAs, Carey, Dudley & Solton (2000:13) categorised them into four categories: (a) *Individual elements removed from the protected area without alteration to the overall structure (e.g. animal species used as bush meat, exotic plants or over-fishing of specific species);* (b) *Overall impoverishment of the ecology of the protected area (e.g. through encroachment, long-term air pollution damage, or persistent poaching pressure);* (c) *Major conversion and land degradation (e.g. through removal of vegetative cover, construction of roads through protected areas, mining activities, etc.); and* (d) *Isolation of protected areas (through major conversion of surrounding land).*

Outside PAs, the threats to biodiversity range from deforestation and habitat fragmentation to encroachment, pollution, invasion of alien species, wild fires, logging and hunting (Ervin, 2003). All of these are largely linked to agriculture (Millennium Ecosystem Assessment [MEA], 2005); hence the importance of considering what role agricultural planners, particularly extension officers, can play in the biodiversity conservation struggle.

The contribution that agricultural extension can make in biodiversity conservation is rarely discussed and remains inadequately exploited. Although agricultural extension primarily focuses on enhancing agricultural production and improving rural livelihoods, international concerns around conservation suggest a re-evaluation and modification of agricultural extension models to suit the current global development and sustainability concerns. This paper, therefore, will explore this question by discussing South Africa's biodiversity and conservation profile, the influence of agriculture (particularly smallholder agriculture) on biodiversity conservation, and agricultural extension paradigms. The paper will finally suggest ways that extension can synchronize the dual objectives of achieving agricultural development and biodiversity conservation by synthesizing the objectives of public agricultural extension with biodiversity conservation targets.

## South Africa's biodiversity and conservation profile

South Africa is one of the countries fortunate to be highly endowed with biodiversity, being home to many species that do not exist anywhere else globally. The nation's biodiversity richness, comprising between 250 000 and 1 million species, ranks third in the world (World Conservation Monitoring Centre, 1992; Wynberg, 2002). South Africa also has a vast collection of landscapes and ecosystems that range from deserts to tropical forests and an extensive variety of marine and coastal bodies. The nation's biodiversity supports production of goods and services generally enjoyed by its populace, including soil fertility, water, atmosphere, food and many others (Shackleton, 2009, citing Scholes & Briggs, 2004). These resources contribute greatly to the country's economy (Twine, Moshe, Netshiluvhi & Siphugu, 2003) and support the livelihoods of several millions of South Africans (Wynberg, 2002; Twine *et al.*, 2003). At the same time, it is noteworthy that South Africa is also home to most of the identified threatened biodiversity species the world over, having the highest concentration of many of them (Wynberg, 2002).

While South Africa has several PAs covering approximately 6% of the national territory, these do not give adequate representation of the full range of the biodiversity types that demand conservation. For example, out of 441 vegetation types found in the country, 110 are not protected at all. In addition, in a case of 90 vegetation types, less than 5% of the area they cover is protected; and for more than 300 vegetation types, less than half of the area which they cover is protected within statutory PAs (Botha, 2004). Furthermore, Botha notes that the absence of species needing protection in the nation's PAs is partly due to the threats that the PAs face from neighbouring communities; although these areas are protected, poaching still occurs. More importantly, some biodiversity needing conservation exists on communal lands that are located outside the boundaries of the designated PAs and are therefore completely without protection. In fact, the National Spatial Biodiversity Agency (NSBA) estimated that between 30-50% of the total communal lands in South Africa occur in priority areas for conservation (Botha, 2004). In accommodating these challenges, the conservation experience in South Africa has witnessed a major transformation from a strict protectionist approach towards one that accommodates sustainable uses of biodiversity resources and inclusion of rural communities in decision-making on conservation of biodiversity that exist on their lands (Wynberg, 2002).

In addition, to address these problems and related ones globally, there was a general agreement among the delegates that attended the recent 2003 World Parks Congress (WPC) held in Durban, South Africa, that the global reserve system needs to be expanded to prevent further disappearance of endangered plants and animals. Indicating South Africa's alignment with the rest of the world on this topic, the South African government emphasizes the earnest need for expanding biodiversity conservation beyond the officially designated PAs, and it makes efforts toward achieving this through its various Departments and Parks Boards (Botha, 2004).

However, from research conducted in South Africa's Eastern Cape, communal land owners do not prioritise conservation, as they perceive that they do not derive direct benefits from biodiversity conservation on their lands. Given

the existence of other income generating land uses, communal land owners usually choose those land uses ahead of biodiversity conservation. If this trend continues, then biodiversity will continue to be threatened in the areas where it has the greatest potential to exist. It follows, therefore, that the identification of an appealing package of incentives derivable from biodiversity conservation and which can motivate communal land owners to adopt land use practices that are compatible with biodiversity conservation, becomes important (Abdu-Raheem, 2010). This paper suggests that, given the fact that the state agricultural extension services have vast knowledge of most values that appeal to communities and are equally close to scientific findings and researchers on biodiversity resources, promoting biodiversity conservation on communal land can and should be undertaken by them.

## Agriculture: the link between biodiversity and agricultural extension

Mitigating the threat of elimination of about a quarter of the total world's wild species and the destruction of significant agro-biodiversity, while simultaneously seeking solutions to the plight of some 800 million people and 1.2 billion people that are suffering from under-nourishment and living in abject poverty respectively, presents a difficult and daunting task (McNeely & Sherr, 2002). Achieving this goal requires a multidisciplinary approach (Wynberg, 2002). Agriculture undoubtedly serves as an overlapping meeting point between the two crystallised objectives of increasing food production and conserving biodiversity. Agricultural production accounts for 67 per cent of land globally (Wood, Sebastian & Scherr, 2000) and has a range of associated ecological footprints (Scherr & McNeely, 2008). Furthermore, the use of land for agriculture may likely increase with time, due to increasing demands for food, as the current global human population is projected to increase to 7.2 billion, 8.3 billion and 9.3 billion by years 2015, 2030 and 2050 respectively (Cohen, 2003; FAO, 2003). Added to this ecological stress is the fact that over 1.1 billion people, most of whom are dependent on agriculture, reside within the locations of the 25 globally

identified biodiversity hot spots (Cincotta & Engelman, 2000; Myers, Mittermeier, Mittermeier, Da Fonseca & Kent, 2002).

The influence of rural communities on biodiversity resources is receiving increased attention. This may be because of the wide range of uses (Shackleton *et al.*, 2007, citing Oksanen *et al.*, 2003 & Lawes *et al.*, 2004) which rural people have for biodiversity resources; or because of the fact that biodiversity resources are most often located in rural and remote environments (Shackleton, Shackleton, Buiten & Bird, 2007). Underscoring the extent of interdependence between biodiversity and rural communities, Shackleton, Shackleton & Cousins (2001) note that income from harvesting wild plant products, particularly in Southern African rural communities, accounts for up to nearly 50 per cent of these communities' total net incomes.

Smallholder farmers are critical to achieving both food security and biodiversity conservation, particularly in the developing countries where 50% of the rural populations are smallholder farmers (United Nations Conference on Trade and Development [UNCTAD], 2010). However, the success of these smallholder food producers depends greatly on increased productivity of land and other natural resources, market integration, technological innovation, human resource capital and social capital development (World Bank, 2006; Abdu-Raheem & Worth, 2011). An effective information system is of paramount importance to implementing a successful sustainable agriculture programme (Mazumadar, 2006), which requires reduced off-farm inputs and increased skills, labour and sound management practices to compensate for the reduced inputs (Cho & Boland, 2004). Allahyari (2009; citing Hersman, 2004) notes that extension can provide the required information network. Extension's role in ensuring successful implementation of sustainable agriculture cannot be over-emphasised (World Bank, 2006; Ahmadvand & Karami, 2007).

## Exploiting extension approaches to enhance conservation-compatible (sustainable) agricultural practice

As South Africa becomes more conscious of the need to combat degradation and unsustainable exploitation of biodiversity species, particularly on communal lands where they mostly occur and are highly threatened, extension emerges as a potentially powerful vehicle to achieve this. This is evidenced through the skills and approaches that extension possesses and can use to create and enact the necessary instruments of change, as may be required by sustainable agricultural practices.

To understand what role agricultural extension can play in addressing South African biodiversity conservation concerns, it is useful to consider the general objectives and approaches of agricultural extension. Swanson (2009) identifies four categories or models of agricultural extension: technology transfer; advisory services; non-formal education; and facilitation extension. Groot and Roling (1998) described a similar range of extension approaches. Worth (2006) suggests a fifth approach: facilitated learning. Table 1 provides a brief comparison of four of these approaches using eight critical factors: purpose, assumptions, source of innovation, promoter's role, farmer's role, supply/demand, orientation and target.

**Table 1:** Comparison of Extension Approaches

| Characteristics | EXTENSION MODELS/APPROACHES | | | |
|---|---|---|---|---|
| | **Linear** | **Advisory** | **Facilitation** | **Learning** |
| **Purpose** | Production increase through transfer of technology<br><br>Government policy | Holistic approach to farm entrepreneurship | Empowerment and ownership | Awakening desire and building skills in learning for advancement as jointly defined by partners |
| **Source of Innovation** | Outside innovations | Outside innovations and by farm manager | Local knowledge and innovations | Synergistic partnership of farmers, researchers and extension |
| **Promoter's Role** | Extending knowledge | Providing advice | Facilitating | Promoting learning skills and facilitating partnerships for learning |
| **Farmer's Role** | Passive: others know what is best<br><br>Adopting recommended technologies | Active: problem solving<br><br>Asking for advice<br><br>Taking management decisions | Active: problem solving; owns the process<br><br>Learning by doing<br><br>Farmer-to-farmer learning | Considering all possibilities<br><br>Contributing to own and others' learning; partner in learning |
| **Assumptions** | Research corresponds to farmer's problem | Farmer knows what advisory services he needs | Farmer willing to learn to interact and to take ownership | Farmer less powerful in learning relationship; needs support in developing desire and skill to learn |
| **Supply/ Demand** | Supply | Demand | Demand | Supply to evoke dynamic relationship of supply and demand |
| **Orientation** | Technology | Client | Process | Client and process and 'right' placement of technology |
| **'Target'** | Individuals<br><br>Farmer organisations<br><br>Projects | Individuals<br><br>Groups with common problems | Groups and organisations, interaction of stakeholders, networking | Farmers in context of a learning partnership<br><br>Others in partnership in context of facilitated learning |

Source: Abdu-Raheem and Worth (2011)

Figure 1 shows the intervention instruments available to agricultural extension to achieve biodiversity conservation, increased agricultural production, increased income, and improved social capital and human capital. The key instruments are social mobilization, education, indigenous knowledge facilitation, linkages and on-going advisory services.

**Intervention Instruments**

a Social mobilization

b Education

c Facilitating local knowledge

d Linkages programme

e On-going farmer engagement

**Incentives to farmers from following conservation-based farming**

a Increased production

b Increased income

c Improved social capital

d Improved human capital

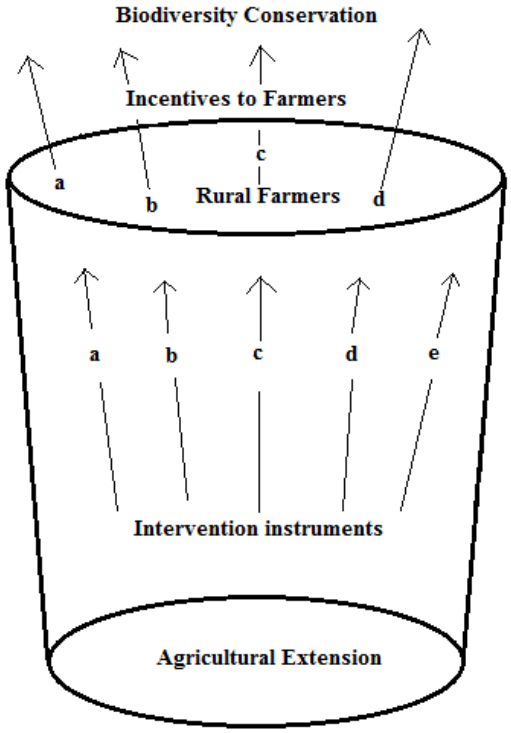


Figure 1: Extension vase for biodiversity conservation

***Social mobilization***

With extension adopting social mobilization in the course of promoting sustainable agriculture among rural farming households, awareness of the new farming system is easily achieved in the community and adoption of the programme could be better guaranteed. Also, different groups could be brought into the programme, namely producer, marketer, credit supplier and consumer. Gray, Phillips & Dunn (2000) indicate that landholders' decisions on land use depend greatly on the relationships among themselves and the general social context of the community in which decisions are being taken.

With the creation of strong social capital within a community, communities stand a better chance of successfully adopting innovations at a general scale to achieve collective results and benefits (Serageldin & Grootaert, 2000; Pretty & Smith, 2004). Stanley, Clousten and Baker (2006) indicate that the collective resources pulled together in a community through exploitation of social capital, in the case of natural resource management, include physical resources, human resources and information resources. Ostrom and Ahn (2001) assert that the importance of social capital in solving problems which require collective action, particularly natural resource management, cannot be overemphasised.

***Education***

One of the many instruments that can be used by extension to enhance the adoption of sustainable practices by smallholder farmers is education. Educational activities can be carried out through one or a combination of the several extension methods of teaching, among which are: workshops, field trainings, field visits and demonstration. Pierotti and Wildcat (2000) note that substantial knowledge of an intervention and literacy influence the willingness of individual rural landholders to engage in collective action that will bring about collective gains. Abadi Ghandim and Pannell (1999) however note that adoption comes through a learning process that can be categorised into two phases: (a) collection, integration

and evaluation of new information in order to make informed decisions about a new innovation; and (b) improvement in the skills of landholders to better adapt the innovation to their local situation.

The first phase indicates that landholders are mostly uncertain about the usefulness and benefits involved in new innovations; and as such, are reluctant to adopt it, if they give it any consideration at all. However, with education, they are more informed and their uncertainties are reduced; thereby leading them to make informed decisions on the newly introduced innovation (Marra, Pannell & Abadi Ghandim, 2003). The second aspect of the learning process assumes that practical implementation of an innovation needs to be based on a degree of background knowledge about the innovation. However, the best-suited method of application of the innovation adaptable to the landholder's environment is only detectable through practice. Therefore, landholders gain higher degrees of knowledge with practical experiences. Worthy of mentioning is the indication made by Pretty and Smith (2004) that the innovation of the farmer field schools for rice management in Asia has resulted in a substantial reduction in the use of pesticides among farmers- about 2 million, 55,000 and 1 million cases in Vietnam, Sri Lanka and Indonesia respectively- in Asian countries. Various literature materials have identified the dynamism and stages involved in the learning process; among these are: Pannell (1999); Barr and Cary (2000); Rogers (2003); and Pannell, Marshall, Barr, Curtis, Vanclay and Wilkinson (2006).

***Facilitating local knowledge***

As shown in Figure 1, extension can facilitate local knowledge to promote adoption of sustainable agricultural systems among rural farmers, through education and indigenous knowledge facilitation. Stanley *et al.* (2006) indicate that some landholders do not share consistent understanding on some uses of land with scientific claims. This is often due to contradicting experiences of landholders over time, as opposed to scientific claims. Richards, Lawrence & Kelly (2003), suggest that farmers' strong attachment to local knowledge and

experiences influence their decisions in adopting new scientific knowledge. Therefore, there is a strong need for extension practitioners to acknowledge local knowledge and make it a basis upon which new knowledge is to be based and improved. Stanley *et al.* (2006, quoting Khanna, 2001) argue that lack of sufficient knowledge on the benefits of a particular technology has also been presented as the reason for non-adoption of such technologies by land managers.

There is a serious need for extension practitioners to update the knowledge of landholders based on scientific developments in order to achieve improved production, with minimum damage to the natural capital. Byron, Curtis and Mackay (2004) indicate that the inaccessibility of landholders to professional advice on a particular technology constitutes a major constraint towards changing land management practices. Although there could be some resistance from landholders towards new technologies, probably because of lack of knowledge about these (Stanley *et al.*, 2006, quoting Khanna, 2001), Pannell *et al.* (2006) suggest that landholders' confidence and the probability of their adoption of new technology increases with increasing knowledge and experience through practice. In order to achieve appreciable receptivity of new technology by landholders, extension practitioners need to provide landholders with access to dependable, practical and understandable information, both on the problem to be tackled and the new technology being offered for adoption (Lockie & Rockloff, 2004).

***Linkages programme***

Another instrument of extension through which sustainable agricultural systems can be promoted among rural farmers is linkages. This implies that extension needs to assist rural landholders to set up a vertical integration with both downstream and upstream organisations and also to establish horizontal integration among people of different interest groups within the rural community, in order to facilitate adoption and maximum return from sustainable agricultural systems being proposed. Swanson (2006) discussed linkages as being in association with building social capital simply because of the fact that all the

parties involved in the link can jointly work together to achieve a common goal or benefit. Putnam (2000) has adopted terminologies like "bonding" and "bridging" in the analysis of the identified linkages. "Bonding", which implies the creation of a network of people with a common vision and goal, has been discussed earlier under the social capital instrument. However, the "bridging" type of social capital or linkage entails that extension creates linkages between rural landholders and outside groups or organisations for the purpose of achieving a common set of goals. For example, research bodies and input markets that sell inputs that comply with the objectives of sustainable agriculture can be linked up with rural farmers. Also, farmers can be linked with output markets that specially deal in the purchases of products from sustainable-compliant type of agricultural production. These linkages will help farmers to secure favourable deals with both the input and output markets; hence, being better encouraged to adopting the new technology of minimum disturbance to biodiversity. Swanson (2006:12) suggests that extension is well positioned to help farmers establish these linkages with relevant groups. He further suggests that this is best achieved using four methods: "helping farmers get organised"; "determining their interests based on accessible market opportunities"; "training these groups in how to produce specific crops/products" and "working with them to develop supply chains in marketing their products".

***On-going farmer engagement***

The last instrument shown in Figure 1, through which extension can promote adoption of sustainable agricultural practices among rural farmers, is on-going farmer engagement. As soon as a farmer adopts an innovation, he experiments with it, most often on a small scale, to see what effects and challenges could come up (Pannell *et al.*, 2006). With this, there is on-going experimentation by the farmer to better adapt the innovation to his own situation. This gradually develops beyond the stage of little training and information provided by agricultural extension, to the degree of sustainable transformation and livelihood improvement (Sturdy *et al.*, 2008). This suggests that landholders'

confidence and probability of adoption of new technology increases with increasing knowledge and experience through practice. To achieve appreciable receptivity of new technology by landholders, extension practitioners therefore need to provide landholders with accessibility to dependable, practical and understandable information, both on the problem to be tackled and on the new technology being offered for adoption (Lockie & Rockloff, 2004). Further to this, they also need to walk with the farmers through the early growing seasons, in which different challenges may be experienced from the adopted technology. This will boost the confidence of the adopting farmers in the technology as well as in the extension personnel; and, will therefore promote an atmosphere of further collaboration between the farmers and the extension officers.

## Conclusion

This paper has highlighted various means by which agricultural extension can help to address the promotion and adoption of sustainable agricultural practices by rural farmers, so as to reduce the threats currently faced by biodiversity in rural communities. Its chief instruments of social mobilization, education, indigenous knowledge facilitation, linkages and on-going advisory services, are effective means of addressing biodiversity conservation concerns at rural community level.

The paper further demonstrates that, by extension focusing on enhancing sustainable agricultural practices through the named instruments, biodiversity conservation, increased agricultural production, increased income, and improved social capital and human capital can be achieved. Thus, it is vital that agricultural extension remains an integral tool of any government to address biodiversity conservation at the rural environment level. Whatever approach or combination of approaches used – technology transfer, advisory, facilitation, or learning – agricultural extension programmes should be re-examined and adjusted so that they are made to contribute to creating and maintaining food security and to alleviating poverty at the household level.

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*CHAPTER 4*

# FOOD SECURITY AND BIODIVERSITY CONSERVATION IN THE CONTEXT OF SUSTAINABLE AGRICULTURE: THE ROLE OF AGRICULTURAL EXTENSION

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## Abstract

Accomplishing household food security simultaneously with biodiversity conservation, particularly on communal farm lands, constitutes a great challenge in South Africa. This is because biodiversity species are being threatened on lands wherein agricultural production is done in the name of securing food availability. The general threats to biodiversity are in the forms of deforestation and habitat fragmentation, encroachment, pollution, invasion of alien species, wild fires, logging, and hunting. Over time, agriculture emerges as the greatest threat to biodiversity. Using this framework, this paper presents a scientific argument, backed with empirical evidence, by exploring the role that agricultural extension can play to realise the goals of biodiversity conservation on South African communal and farm lands. Drawing on relevant published works, this paper argues that extension is particularly well positioned to address both food security and biodiversity conservation concerns through the instruments of linkages, local knowledge facilitation, social capital and education.

Keywords: Agricultural extension, Biodiversity conservation, Food security, Sustainable agriculture

## Introduction

Reducing the threats of eradication of about a quarter of the total world's wild species and obliteration of important agro-biodiversity, while simultaneously seeking solutions to the plight of some 800 million and 1.2 billion people suffering from under-nourishment and living in abject poverty respectively, presents a difficult and overwhelming task (McNeely & Sherr, 2002). Environmental sustainability and food security are both part of the Millennium Development Goals (MDGs) which must be achieved concurrently. Food and nutrition security feature in Target 2 of Goal 1, which seeks to "halve the proportion of people who suffer from hunger", while biodiversity conservation features as Target 7, which seeks to "ensure environmental sustainability" (United Nations Development Programme [UNDP], 2006:4). Alleviating worldwide food insecurity without compromising natural biodiversity resources remains an elusive objective wherein further research is needed.

The fact that the extremely poor and food-insecure populations reside in countries with the largest biodiversity resources (United Nations Division for Sustainable Development, 1992; World Summit on Sustainable Development, 2002) suggests that efforts towards solving the problems of food security and biodiversity conservation should not be done in isolation to each other. The Food and Agricultural Organisation (FAO) and the International Plant Genetic Resources Institute (IPGRI) are two international institutions which contribute immensely to research work geared towards achieving both objectives concurrently. They have initiated a concept of biodiversity for food and nutrition in order to design and implement plans of action relating to food and nutrition security, while simultaneously encouraging the sustainable use of biodiversity resources. Through this, they highlight the importance of biodiversity and the role it has to play in achieving sustainable development (Esquinas-Alcazar, 2005).

While food security is an issue of concern in all developing countries, it is of particular concern in Africa where food insecurity is severe. One major underlining factor severally reported in relevant literature is that the per capita

food production in Africa is not keeping pace with population growth. This is in contrast to situations in other developing countries, where food production is keeping pace with population growth (FAO, 1996). In South Africa, food security can be viewed on two levels: 'national food security' and 'household food security'. As a nation, according to National Food Security indicators, South Africa is food secure. In fact, South Africa has been nationally food secure for more than twenty years and is even an exporter of some foods. It excels in the production of some varieties of agricultural food products like maize and potatoes and it imports products which it lacks or produces inadequately, all contributing to meeting its national food requirements (Hirschowitz, 2000).

At household level, however, South Africa is not universally food secure, with some 14.3 million South Africans (about 35% of the total population) experiencing food insecurity (Hirschowitz, 2000). Many of these people are largely dependent on the natural resources available to them for their livelihoods. These resources are often used unsustainably and it is in this context that the South African government has expressed its desire to ensure that food security is achieved at household level (Altman, Hart & Jacobs, 2009), concomitantly meeting its conservation objectives (Botha, 2004).

South Africa is blessed in terms of biodiversity wealth. It is recognized as one of the 17 "mega- diversity" nations of the world. Although South Africa covers 2% of the total world's land area, it is home to not less than 10% of the world's total plants and 7% each of mammals, reptiles and birds. While South Africa has several Protected Areas (PAs) covering approximately 6% of the national territory, these areas do not give adequate protection to the full range of biodiversity types that demand conservation. For example, of the 441 vegetation types found in the country, 110 are not protected at all. In addition, for 90 vegetation types, less than 5% of the area they cover is protected, and for more than 300 vegetation types, less than half the area which they cover is protected within statutory PAs (Botha, 2004).

In the light of the food and conservation needs of South Africa outlined so far, there is an urgent need to explore solutions to fulfil both objectives

simultaneously. This paper is thus aimed at identifying possible contributions that agricultural extension could make to achieve this dual objective.

## Agricultural biodiversity: the link between biodiversity and food security

That South Africa is a mega-diversity nation (Botha, 2004), with agricultural production constituting 50% of the source of threats to its biodiversity (Biggs, Reyers & Scholes, 2006), highlights the inextricable link between realizing food security and biodiversity conservation within the country. Biodiversity implies the disparity among genes, species and ecosystems, and variation in organization, role and composition at each of these cadres (Biggs *et al.,* 2006, citing Noss, 1990). Food security, on the other hand, refers to "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2010:8).

The two objectives overlap in the concept of "agricultural biodiversity". Agricultural biodiversity – henceforth referred to as 'agro-biodiversity'– encompasses the variety and variability of animals, plants and micro-organisms which are necessary for sustaining key functions of the agro-ecosystem, its structure and processes that are associated with food production and food security (FAO, 1999). Wild biodiversity, which is equally exploited for a variety of uses by man, is the variety and variability of non-domesticated plant and animal species (McNeely & Scherr, 2003), and the ecosystems comprising these species (Dollacker & Rhodes, 2007). This indicates that biodiversity, both agro and wild, supplies the food we consume and the means to produce it. It is the conglomerate of the different components of this biodiversity wealth that are becoming extinct, thereby creating food shortages in the world.

It is posited that achieving food security is hardly realistic in the context of the unprecedented rate at which the agro-biodiversity resources are being lost. Pimm and Raven (2000) note that between 10 000 and 10 million species become

extinct globally each decade. They further warn that up to 40% of biodiversity species in Myer's 25 hotspots could disappear if deforestation continues at the present rate. The International Union for Conservation of Nature (IUCN) (2007) also indicates that 31%, 12% and 20% of amphibian, bird and mammal species, respectively, are currently facing extinction; while plant species are simultaneously undergoing rapid disappearance in Central and West Africa, Central and South America, and Southeast Asia. Similarly, Hughes, Byrnes, Kirnbro & Stachowicz (2007) forecast that between 0.1% and 0.3% (14,000 to 40,000) of tropical forest species become extinct every year. Furthermore, BirdLife International (2000) also envisages that 13% of the global bird species will disappear within a century, 99% of which would be as a result of hunting and deforestation.

In the context of South Africa as well, the impact on biodiversity sustainability of wild biodiversity removal and trade is considerable (Shackleton, 2009). Millions of households rely on biodiversity for medicinal and cultural purposes (Shackleton, 2005), fuel wood (Twine, Moshe, Netshiluvhi & Siphugu, 2003), foods (Clark, Hauck, Harris, Salo & Russell, 2002; UNDP, 2006), veterinary medicine (Dold & Cocks, 2001) and for general livelihood (Shackleton & Shackleton, 2004). The pressure biodiversity faces in South Africa, coupled with the world-wide threats to biodiversity, forewarns of a serious decline in biodiversity and highlights the enormity of the challenge ahead if achieving food security at the grassroots, both globally and nationally, is to be realized.

Apart from the fact that human existence depends on food derivable from biodiversity, it is important to note that biodiversity resources also serve as a source of numerous raw materials which enhance survival and development of the human world. Such materials include fibre for clothing, materials for fuel, medicine, transportation, fertilizer and shelter, to mention only a few (Shand, 1997). Notwithstanding these physical benefits, biodiversity also serves as the centre-piece upon which the smooth functioning of the planet earth depends - maintaining balances in atmospheric gases and generation of oxygen, regularization of climatic conditions, maintenance of regular supply and quality of

water, pollination, regularization and protection of top soil, conversion of solar energy to planet matter, decomposition of organic materials and nutrients recycling, and curbing outbreaks of pests and diseases (Hooper, Chapin & Ewil *et al.*, 2005).

## Food security and sustainability: the need to clarify the goal

As more efforts need to be geared towards abating the ever-increasing challenge of global food insecurity, particularly at the household level, greater attention and focus should be directed towards sustainability (FAO, 2009). Globally, sufficient food is produced to make it possible to achieve food security (Islam, 1995; FAO, 2002), but the number of the undernourished has risen from about 840 million in 1996 (FAO, 1996) to about 925 million in 2010 (FAO, 2010). The World Bank (2011) indicates that due to food price increases in 2011, an additional 44 million people have fallen below the poverty line of USD1.25 per person, per day. The global maize price increased by 17% in the first quarter of 2011 as compared to the last quarter of 2010, with the impact felt and localized more in Sub-Saharan Africa (World Bank, 2011).

The increase in food prices is attributed to the recent increase in the prices of crude oil by 10% in March, 2011 (World Bank Food Price Watch [WBFPW], 2011). The WBFPW also noted that the increase in crude oil prices impacts on food prices in three ways: increased promotion for the use of food products like corn, vegetable oil and sugar for biofuels production (which creates greater competition for food); increased cost of food production based on higher prices of fertilizer, irrigation and other farm inputs; and increased cost of crop transportation to destination markets.

The FAO (2010) argues that the second of the factors identified by the WBFPW (the cost of food production) is directly related to the current extensive agricultural practices which rely on external inputs. The FAO further argues that these extensive farming systems need to be substituted by a low external input production system (FAO, 2010). The external inputs pose great threats to

biodiversity and essential ecosystem services (Millennium Ecosystem Assessment [MEA], 2005). Nellemann, MacDevette and Manders (2009) indicate that unless and until sustainable agricultural practices are adopted widely, food prices will continue to soar. Thus, it can be argued that the extensive system contributes to maintaining persistent unsustainable production of food and the consequent food security crisis.

The depletion effect on significant biodiversity of most agricultural production systems currently in use has left major agricultural lands impoverished and at the mercy of the perpetual use of external inputs for appreciable production. If this trend continues, about 1 billion hectares of natural ecosystems would have to be converted for agricultural uses (FAO, 2010). Tilman, Fargione & Wolff *et al.* (2001) add that this will amount to between a 2.4 and 2.7-fold increase in eutrophication of fresh water, terrestrial and near-shore marine ecosystems and increased use of nitrogen and phosphorus. However, as a note of caution on the current rate of phosphorus usage, Vaccary (2009) warns that phosphorus will be a limiting factor to agricultural production by the end of this century as, Vaccary suggests, the present stock of phosphorus is nearing exhaustion.

Many management practices have been developed and identified as ways forward from the *status quo*. These include integrated pest management, improved soil and water management, eco-agriculture, conservation agriculture, and organic agriculture (FAO, 2010). All these practices are intended to enhance biological processes such as nutrient cycling, pest control, pollination and carbon sequestration (Power, 2010), and involve increased but more efficient use of biodiversity for food and agriculture (FAO, 2010).

## Farmers: bedrock to concurrent achievement of biodiversity conservation and food security

Developing an efficient agricultural system that embodies natural resource sustainability concurrently with food security solutions, requires holistic,

interdisciplinary ecosystem and biologically-based interventions, and this should necessarily consider the social, economic, and cultural aspects of agriculture (MEA, 2005; International Assessment of Agricultural Knowledge, Science and Technology Development [IAASTD], 2008). In addition, such an agricultural system needs to recognize the multifunctional role of agriculture, the broad-range services including provisioning, regulating, supporting, and socio-cultural services supplied by agro-biodiversity, and the importance of smallholder farmers as one of the major stakeholders that could bring about the desired change (FAO, 2010).

About 50% of rural populations in developing countries are smallholder farmers (United Nations Conference on Trade and Development [UNCTAD], 2010), while another 20% are landless (FAO, 2010). These farmers engage in different forms of agricultural production ranging from pastoralism to aquaculture and artisanal fishing (FAO, 2010). Morton (2007) indicates that the farming systems used by smallholder farmers are often complex and diverse, which may even assist them to cope better with risks. These smallholder farmers, as may be deduced, play vital roles in the management of vast agricultural landscapes in the developing nations and are, therefore, central to the management of the biodiversity resources of these countries. Thus, it is suggested that improvements in farming systems need to be relevant to the context of these smallholder farmers if significant progress is to be achieved, in terms of reducing the number of the food-insecure while saving biodiversity from extinction.

Shand (1997) indicates that the hunt for long-lasting food security measures has to begin with the regions where diversified food materials are produced and with the people behind the production, as they are best suited to innovating new technologies and farming systems that best suit their varied biological environments. Shand furthermore notes that, instead of accentuating external technologies and other production inputs, sustainable food security for the globe is better achieved by improving on the local knowledge, resources and strength of the rural farming communities. In the light of this logical reasoning, attention to the needs and enhancement of the capabilities of the major stakeholders that are in charge of conservation and exploitation of agro-

biodiversity resources, the rural farmers, should constitute the focus of all agricultural policies being created to tackle the current state of the world's food insecurity.

## How can agricultural extension contribute in this challenge?

As South Africa sets out to combat degradation and unsustainable exploitation of its biodiversity species in the context of enhancing food security at household level, agricultural extension emerges as a potentially influential tool to achieve this. This is evidenced through the skills and approaches that extension possesses, and which it can use to create and facilitate the necessary instruments of change as may be required by sustainable agricultural practices.

Understanding the general objectives and approaches of agricultural extension will help to shed light on the role that extension can play in addressing South African biodiversity conservation and household food security concerns. Swanson (2009) identified four categories or models of agricultural extension: technology transfer; advisory services; non-formal education; and facilitation extension. Groot and Roling (1998) describe a similar range of extension approaches. Worth (2006) suggests a fifth approach: facilitated learning. Table 1 provides a brief comparison of four of these approaches using eight critical factors: purpose, assumptions, source of innovation, promoter's role, farmers' role, supply/demand, orientation and target.

**Table 1:** Comparison of Extension Approaches

| Characteristics | EXTENSION MODELS/APPROACHES | | | |
|---|---|---|---|---|
| | **Linear** | **Advisory** | **Facilitation** | **Learning** |
| **Purpose** | Production increase through transfer of technology<br><br>Government policy | Holistic approach to farm entrepreneurship | Empowerment and ownership | Awakening desire and building skills in learning for advancement as jointly defined by partners |
| **Source of Innovation** | Outside innovations | Outside innovations and by farm manager | Local knowledge and innovations | Synergistic partnership of farmers, researchers and extension |
| **Promoter's Role** | Extending knowledge | Providing advice | Facilitating | Promoting learning skills and facilitating partnerships for learning |
| **Farmer's Role** | Passive: others know what is best<br><br>Adopting recommended technologies | Active: problem solving<br><br>Asking for advice<br><br>Taking management decisions | Active: problem solving; owns the process<br><br>Learning by doing<br><br>Farmer-to-farmer learning | Considering all possibilities<br><br>Contributing to own and others' learning; partner in learning |
| **Assumptions** | Research corresponds to farmer's problem | Farmer knows what advisory services he needs | Farmer willing to learn to interact and to take ownership | Farmer less powerful in learning relationship; needs support in developing desire and skill to learn |
| **Supply/ Demand** | Supply | Demand | Demand | Supply to evoke dynamic relationship of supply and demand |
| **Orientation** | Technology | Client | Process | Client and process and 'right' placement of technology |
| **'Target'** | Individuals<br><br>Farmer organisations<br><br>Projects | Individuals<br><br>Groups with common problems | Groups and organisations, interaction of stakeholders, networking | Farmers in context of a learning partnership<br><br>Others in partnership in context of facilitated learning |

Source: Abdu-Raheem and Worth (2011)

Figure 1 shows the intervention instruments available to agricultural extension, in order to achieve biodiversity conservation in the context of promoting food security through sustainable agricultural production and management. The key instruments are linkages, local knowledge facilitation, social capital and education.

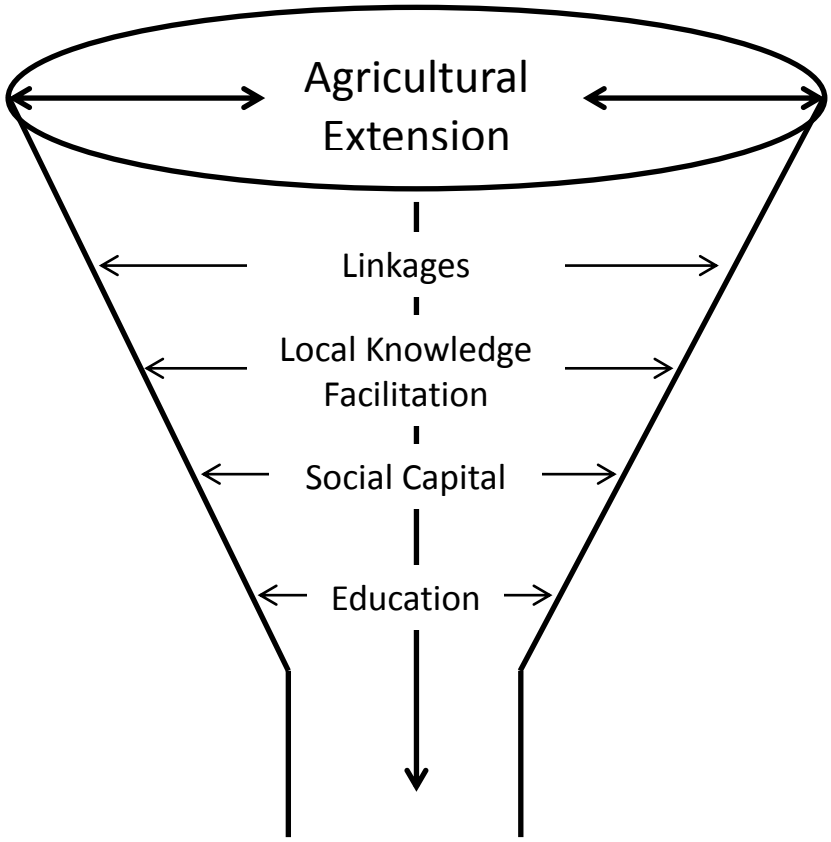


Figure 1: Extension funnel for sustainable agriculture

***Linkages***

As indicated in Figure 1, the first instrument available to agricultural extension to enhance promotion and adoption of sustainable agriculture among rural landholders is 'linkages'. This indicates that extension can assist rural landholders to set up a two-way relationship with biodiversity conservation institutes in order to facilitate free flow of information between both parties. Swanson (2006) indicates that 'linkages' has an association with building social

capital. This is because all parties involved combine efforts towards achieving a common goal. Putnam (2000), however, suggests terminologies like "bonding" and "bridging" in the description of possible linkages that extension may build for success to be achieved by farmers in any innovation adoption exercise. "Bonding", the creation of a network of people with the aim of achieving a common goal, relates to the creation of partnerships between landholders and different groups within the community, so that all relevant stakeholders are purposefully engaged in achieving their common goal. For example, rural landholders can be linked with other rural groups like marketing, credit and consumer groups to facilitate participation in the different stages of the food supply chain, thereby resulting in synergy, where they derive greater strength from working together than they would by working individually.

"Bridging" entails linkages created by extension between rural landholders and external organizations in order that problem identification and solution seeking efforts will not be pursued in isolation from each other. For example, suppliers of sustainable agriculture inputs can be linked (bridged) with rural farmers so that access to such inputs by farmers is facilitated. These linkages will help farmers receive advice that is relevant to their local conditions, secure favourable deals with both the input and output markets, and be better placed to adopt new technology of minimum disturbance to biodiversity. Swanson (2006:12) indicates that extension is well positioned to assist farmers with establishing relationships with relevant and important groups. He suggests four ways through which this responsibility is better achieved, namely: "helping farmers get organised"; "determining their interests based on accessible market opportunities"; "training these groups in how to produce specific crops/products"; and "working with them to develop supply chains in marketing their products".

***Local knowledge facilitation***

Also indicated in Figure 1 is 'local knowledge facilitation' as one of the viable tools available to extension to facilitate adoption of sustainable agricultural

systems by rural farmers. Stanley, Clouston and Baker (2006) indicate that landholders often do not share the same views with scientists who propose land usage on the basis of scientific research. They claim that this situation arises from the experiences of landholders that often contradict scientific claims over time. Supporting this view is the submission by Richards, Lawrence and Kelly (2003) which indicates that landholders' strong attachment to local knowledge and experiences affects their decisions relative to adopting new scientific innovations. With this in view, extension practitioners seriously need to acknowledge local knowledge and take it into account when finding solutions to some of the problems that landholders experience on their farms.

Stanley *et al.* (2006, quoting Khanna, 2001) also argue that inadequate knowledge of the derivable benefits from a particular innovation has a strong correlation with non-adoption of such technology by landholders. Therefore, extension practitioners need to seek suitable media that can adequately facilitate the exchange and collaborative sharing of knowledge and skills between landholders and scientists. Seeking improved media for knowledge sharing may also help solve the challenge of inaccessibility that landholders face relative to professional advice on new technologies (Byron, Curtis and Mackay, 2004). Furthermore, Byron *et al.* indicate that inaccessibility challenges constitute a major constraint towards changing land management practices by landholders. While some resistance may ensue from landholders towards new technologies on the basis of inadequate knowledge (Stanley *et al.*, 2006, citing Khanna, 2001), Pannell, Marshall, Barr, Curtis, Vanclay and Wilkinson (2006) note that landholders' confidence and the possibility of adoption of new technology increase with increased knowledge and experience. Thus, in order to significantly improve receptivity to new technologies by landholders, extension practitioners will have to provide landowners with access to dependable, practical and understandable information (Lockie & Rockloff, 2004).

This is not to suggest that knowledge sharing should only be one-sided, that is from researchers to landholders. Rather, there should be collaboration between both groups wherein the different skills and knowledge of each group is

shared with the other, thereby complimenting one another. Many researchers like Reijntjes and Waters-Bayer (2001), Saad (2002) and Hoffmann, Probst and Christinck (2007) have pointed out the importance of local knowledge and the ability and capacity demonstrated by landholders to experiment and innovate successfully on their own. However, Hoffmann *et al.* (2007) suggest that the mutual comparative advantages of both farmers and researchers are more optimally harnessed and relevant agricultural knowledge and innovation are more efficiently generated when landowners and researchers collaborate. They (Hoffmann *et al*., 2007:358) further argue that successful collaboration is based on the following principles:

> "there are complementary roles for farmers and researchers in setting research priorities";
>
> "there is a need for decentralized community-based technology testing that makes use of the farmers' experimentation and dissemination capacity";
>
> "formal research should be more open to farmers' informal experimentation";
>
> "more attention needs to be paid to the externalization of expert farmers' tacit knowledge"; and
>
> "opportunity costs should be respected if farmers dedicate time to research".

***Social capital***

Social capital, also indicated in Figure 1, is another instrument that extension can adopt to facilitate promotion and adoption of sustainable agricultural practices among rural landholders. One of the numerous contributions it can make is that different rural groups, such as producers, marketing, credit and consumer groups, can be convinced to work together and accommodated within the new innovation programme, thereby facilitating the processes involved in the various phases of production, through to selling farm produce. Gray, Phillips and Dunn (2000) indicate that landholders' decisions on land use have a correlation

with the relationships that exist among themselves and the context of the society within which decisions are being taken.

Adoption of new innovations on a large scale within a community has been established to be greatly dependent on strong social capital (Serageldin & Grootaert, 2000; Pretty & Smith, 2004). Relative to natural resource management, Stanley *et al.* (2006) indicate that communities exploiting their social capital can contribute physical resources, human resources and information resources towards successful development, adoption and implementation of any innovation that will assist them to generate common benefits from their natural resources. In addition, Ostrom and Ahn (2001) assert that the importance of social capital in solving problems which require collective action, particularly natural resource management, cannot be overemphasised.

Pretty and Ward (2001: 211) identify that social capital comprises of four core aspects: (a) relations of trust, (b) reciprocity and exchanges, (c) common rules, norms, and sanctions, and (d) connectedness in networks and groups. Wu and Pretty (2004) further note that the importance of social capital to innovation is often underestimated. In their research in marginal locations of China, Wu and Pretty demonstrated the importance of social capital to innovation development and adoption by identifying the positive impacts that the various levels of organizational arrangements, ranging from household communication networks, to inter-household technology learning groups and inter-village innovative links, have on agricultural and natural resource innovation, which translated into improved rural incomes.

***Education***

The last instrument indicated in Figure 1 as being available to extension to influence adoption of sustainable agricultural practices by smallholder farmers is 'education'. Educational activities can be carried out through different combinations of the numerous extension methods of teaching, ranging from workshops and field trainings, to field visits and demonstrations. Pierotti and

Wildcat (2000) note that substantial knowledge of an intervention and literacy affect the readiness of individual landholders to engage in collective action to achieve collective gains. However, Abadi Ghandim and Pannell (1999) note that adoption is achieved through two phases of a learning process. The first entails the collection, integration and evaluation of available information in order to make an informed decision about a new innovation; the second, borders on improvement in skills of landholders through practice, for better adaptation of new innovations to their local circumstances.

The first phase indicates that landholders are frequently unsure of the usefulness and benefits embedded in new innovations; hence the explanation behind their reservations towards adoption. With education, however, Marra, Pannell and Abadi Ghandim (2003) indicate that farmers' uncertainties are reduced and they become better informed as to what decisions to make on newly introduced innovations. The second phase of the learning process indicates that full adoption of an innovation is often based on a high degree of knowledge, which is mostly acquired through landholders' experience when testing adoption on a small scale. This assists landholders to identify the best-suited methodology of application of the innovation in the context of their environment. Reiterating the importance of education on adoption and successful implementation of an innovation, Pretty and Smith (2004) submit that the farmer field schools for rice management that have been introduced in Asia, have resulted in a substantial reduction in the use of pesticides among farmers. Various researchers such as Pannell (1999), Barr and Cary (2000), Rogers (2003), and Pannell *et al.* (2006) have helped to identify the dynamism and stages involved in a learning process that precedes adoption of any innovation.

However, an important challenge is that of educating the biodiversity and agricultural researchers to genuinely engage with local knowledge. Normann and Snyman (1996:121) argue that agricultural research has failed in Africa precisely because of the failure of research scientists to understand, relate to and work with African farmers and their particular knowledge set; "...they find themselves not particularly well adapted to the research needs of the African farmer. This stems

primarily from (1) the crop-specific or input-specific approaches commonly used by these institutions, (2) poor understanding of the African farmer and his farming practices by research scientists, (3) doubt by Western agricultural research experts whether the complex African farming systems can be transformed for increased food production, and (4) the arrogance and unwillingness of agricultural scientists to learn from the traditional African farmer". This suggests that research scientists need to understand the dynamics of how things work in a typical rural environment and be ready to acknowledge and build upon local knowledge. It also suggests that experts should adopt a more participatory approach with landholders, rather than treating them as mere recipients of externally innovated technology.

## Conclusion

This paper has highlighted various means by which agricultural extension can help address innovation, development, and adoption of sustainable agricultural practices among rural landholders. Its chief instruments of linkages, local knowledge facilitation, social capital and education are effective means of addressing food security challenges simultaneously with biodiversity conservation. The paper acknowledges that while the approach (as depicted in the Extension Funnel) is relatively straightforward, it is a complex process that one should not attempt to oversimplify. It will require deliberate, conscious effort sustained over time. The paper demonstrates that, by focusing on enhancing sustainable agricultural production and management practices, both objectives of food security and conservation of biodiversity can be achieved on rural farm lands. Thus, it is vital that agriculture remains an integral part of any government's strategy to address food insecurity and biodiversity conservation challenges on rural farm lands. Whatever approach or combination of approaches used – technology transfer, advisory, facilitation, or learning – agricultural extension programmes should be re-examined and adjusted so that they contribute

to creating and maintaining food security, as well as biodiversity conservation, on lands beyond the fences of officially designated PAs.

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*CHAPTER 5*

# EXPLORING THE ROLES OF AGRICULTURAL EXTENSION IN PROMOTING FOOD SECURITY IN KWAZULU-NATAL PROVINCE, SOUTH AFRICA

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## Abstract

Household food security remains a challenge in South Africa. The national government instituted the Integrated Food Security Strategy (IFSS) programme which identifies household agricultural production as an important element of improving household-level food security. Agricultural extension is well positioned to help achieve this aim, but its current contribution is unknown. This study identified the roles of extension in household food security in KZN by investigating, primarily from the perspective of state service providers, the current activities of extension to enhance household food security, and the factors impacting on effective delivery of extension services with respect to household food security.

Data were collected through semi-structured interviews with 46 respondents, comprising of various national and provincial-level food security and extension managers and extension practitioners, and also food security/extension officers from two NGOs, as well as farmers.

The study found that extension engages primarily in technology transfer and supply of farming inputs like seeds and fertilizers to the farming households. Three sets of factors affecting extension's capacity to promote food security emerged: household/community-level factors**,** social factors and service delivery factors**.** In the light of this, the study suggests the need for both food security and extension objectives to be consolidated into an extension policy that will explicitly charge extension to enhance household food security through a capacity development approach, while also providing for the accountability of extension to farmers.

Keywords: Agricultural extension, food security, household, KwaZulu-Natal

## Introduction

Seeking appropriate solutions to challenge food security in South Africa remains a herculean task. The country is nationally food secure (Food and Agricultural Organisation-[FAO], 2008) to the extent that should make it possible for all its citizens to be food secure. However, significantly large numbers of its households remain hungry (Altman, Hart & Jacobs, 2009). About 21.1% of them are inadequately or severely inadequately vulnerable to hunger (Statistics South Africa [Stats SA], 2012). Table 1 provides another perspective of the extent of vulnerable households per province in South Africa.

Table 1: Population and extent of food inaccessibility in South Africa by province

| Provinces | Population ('000s) | Number of households ('000s) | Food Inaccessibility (% of households) |
|---|---|---|---|
| Western Cape | 5,565 | 1,581 | 23.4 |
| Eastern Cape | 6,657 | 1,820 | 25 |
| Northern Cape | 1,159 | 328 | 29.7 |
| Free State | 2,932 | 907 | 22.7 |
| KwaZulu-Natal | 10,632 | 2,802 | 17.7 |
| North West | 3,500 | 1,006 | 32.9 |
| Gauteng | 10,950 | 3,826 | 18.5 |
| Mpumalanga | 3,665 | 1,050 | 26.1 |
| Limpopo | 5,264 | 1,437 | 13.2 |
| **Total** | **50,325** | **14,756** | |

**Source:** Stats SA (2012); and adapted by Abdu-Raheem and Worth

Table 1 shows that KwaZulu-Natal (KZN) is the second most populous province, with an estimate of 10,632 million people. The province has above 2, 8 million households, of which 17.7% are food inaccessible. Apart from the food inaccessibility condition, the province also has the highest percentage of HIV/AIDS infected persons, whether measured by the population of the infected, the antenatal clinic estimate, or by the number of infected adults (between 20-64 years of age) (Nicolay, 2008). Given the negative relationship between food security and HIV and AIDS (Piot, Pinstrup-Andersen, Gillespie & Haddad, 2002; Human Sciences Research Council [HSRC], 2005), it is submitted that food insecurity in KZN will continue to increase unless effective measures are quickly put in place (Cross, 2002; Drimie, 2003).

The location of a household can also impact on its food security status. Rural areas, characterized by fewer economic activities, poor structural and social infrastructure, and a high unemployment rate, predispose habitants to food insecurity (Stats SA, 2004; Aliber, 2009; National Agricultural Marketing Council [NAMC] 2009; Jacobs, 2009). This predisposition is, therefore, particularly true for KZN, which has about 87% of its poor people residing in rural areas (Aliber, 2003).

Rural families have high propensities to rely on farming for their livelihood. The majority of these people are in direct need of food, as well as monetary income. They have access to land, but lack the necessary skills and resources to profitably produce from farming. For these people to achieve food security they will need public agricultural extension services. Such services, particularly to small scale farmers, require significant improvement (FAO, 2009). About 804,174 households in KZN (28.7%) rely on farming for their livelihood (Stats SA, 2012). These factors are applicable to KZN, making it well-suited as a research area.

## Purpose and objectives

This study examined the roles which extension plays in household food security in KZN. It investigated the current activities of extension to enhance household food security, and the factors affecting effective delivery of extension services with respect to household food security and with particular emphasis on small-scale farming. The purpose of the study was to determine how and through what means public agricultural extension could contribute to household food security through its engagement with small-scale farmers.

## Methods

Data was collected through semi-structured interviews with forty-six respondents. Thirteen respondents comprising three provincial food security managers, two national food security managers, four provincial agricultural extension managers, one national extension manager, and three food security/extension officers from two NGO organizations were selected by purposive sampling. Twenty-five public extension officers and eight farmers were among the respondents selected by convenience sampling.

Purposive sampling allowed for selecting "information rich" respondents (Patton, 1990: 169), with specific characteristics relevant to the objectives of this research (Silverman, 2010). Convenience sampling allowed for the selection of respondents from a relatively homogenous population (Saunders, Lewis & Thornhill, 2007) that were available and willing to participate at the time of data gathering (Onwuegbuzie & Leech, 2007). Convenience sampling was suitable as respondents were sparsely distributed and difficult to track down, coupled with an anticipated low response rate to questionnaires and the limited financial resources of the researcher. Sample size was not pre-determined, but based on the principle of saturation (Glaser & Strauss, 1967). Hence, the researcher continued investigations until no new insights were gained from additional interviews.

Informed consent was obtained from each participant prior to data collection. The face and content validity of the interview questions was done with the assistance of experts in the fields of Agricultural Extension and Food Security from the University of KwaZulu-Natal, South Africa. Re-wording and re-structuring of the questions followed in line with suggestions and recommendations from the reviewers. All data collection took place between September, 2011, and September, 2012.

Interviews began with the national and provincial managers for both extension and food security and were carried out in venues convenient to the respondents. These were followed by the interviews with the field extension agents, private food security/extension personnel and farmers. The researcher exploited the opportunities of on-going Extension Recovery and Food Security programmes to interview the field extension agents, private food security/extension personnel and farmers. General invitations were given to all participants in the programmes, and those who responded were interviewed. To overcome some respondents' reluctance to participate, the researcher occasionally tried to make the interview process more casual by asking questions while walking together.

Notes were taken during each interview and discussions were simultaneously tape-recorded for further review and cross-checking. The questions were purposefully varied in wording to suit the English proficiency of individual respondents. Participants were given ample time to respond and, where necessary, to elaborate on answers. Responses were probed with follow-up questions to clarify responses and to evoke more detail. Reviewing and analysing data was done continuously alongside data collection. Post-interview clarification of unclear responses was conducted through follow-up telephonic interviews.

Policy and operational documents relevant to the study were examined using content analysis, as they contained qualitative text data (Hsieh & Shannon, 2005). Content analysis allowed for focusing on language-usage in the texts for contextual interpretations (Tesch, 1990), and gaining background knowledge and

understanding (Downe-Wamboldt, 1992) relative to the concepts under investigation.

## Results

This section presents the results from the forty-six interviews and the analysis of documents.

***National extension manager***

The respondent was asked questions aimed at evaluating the general extension system in the country, and, more specifically, to explore the extent to which national extension policy indicates extension's role in promoting food security. The respondent could not effectively engage with all these questions, but did submit that:

> *The way the government of South Africa is structured, extension is only happening at the provincial level …the implementation of the national extension strategies and evaluation of extension activities in relation to other sectors can only be done at the provinces …. At the national office, we only engage in developing and recommending policies, frameworks and approaches to guide on how to go about extension services in the provinces.*

Responding to questions investigating national extension policy in relation to extension's role in enhancing food security, the manager indicated that the current policy, 'Norms and Standards for Agricultural Extension and Advisory Services', was developed and compiled in 2005 (Department of Agriculture, 2005). Prior to this, there was no national framework to guide extension and advisory services in the country. He stated that the framework document was developed to respond to a dual agricultural landscape inherited from the apartheid regime in 1994 and comprised in the main, on the one hand, of white commercial farmers with well-resourced extension support and adequate access to productive

assets and commercial markets, and, on the other, of black farmers with restricted access to production assets (mainly land) and markets, and who were supported by a poorly-resourced 'homeland' extension system.

Furthermore, the manager noted that during the apartheid era, poor extension provided to the resource-poor black producers crippled the capacity of black farmers beyond the end of apartheid and well into the new democratic South Africa. As a result of this, poverty and associated food insecurity is deeply entrenched among black families and the current democratic dispensation is focused on empowering these families through well-resourced extension support systems to transform them into commercial farmers. The respondent noted that the Norms and Standard document was based on a principle of 'Participatory Programmed Extension Approach' for an effective extension delivery system.

In addition, in 2008, an Extension Recovery Plan Framework was conceived and agreed to by various agricultural stakeholders to further enhance the effectiveness of agricultural extension in the country. To this end, the manager interviewed provided the following general account of extension in the country:

> *Extension is not really doing well at all … the kind of extension we have in South Africa, I must tell you, is the weakest link ... and in response to this, we developed an Extension Recovery Plan which is meant at revamping extension services in 2008. Because of the problems that are still with extension services in South Africa, we are also planning to amend the national policy very soon to make it more suitable to respond to our current problems.*

***National food security managers***

Two respondents were interviewed with questions investigating the general assessment of food security in the country and where the current gaps lay. They were also asked about the relevance of the current food security policy to extension and the importance and assessment of extension's contributions to food security efforts.

The respondents acknowledged South Africa to be nationally food secure and that security challenges mainly occur at household and individual level. It was gathered that the importance of agriculture to food security was nationally conceived, acknowledged and embodied in an 'Integrated Food Security Strategy' (IFSS) that specifically aims at increasing household food security through increased agricultural production and trading in rural areas. They further noted that although the programme also includes commercial farmers, it mainly focuses on subsistence and emerging farmers by facilitating their increased access to production assets, value-adding technologies, agricultural extension support, infrastructure and markets – the latter through suitable trade regulations.

Table 2 summarises the overall responses within three main themes: assessment of food security in the nation; the relevance of food security efforts to extension; and assessment of extension's effectiveness in contributing to food security and the factors affecting that contribution.

Table 2: Thematic descriptions drawn from interviews with national food security managers

| **Thematic descriptions** | **Factors identified** |
|---|---|
| Assessment of food security in the nation | - There is national food security but many households are still hungry<br>- Food access is the key challenge for most households<br>- 50% of rural households' social grants are spent on commercially produced foods<br>- Poor rural infrastructure increases households' food expenditure<br>- Rural households possess inadequate production assets, including land and extension services<br>- Food wastages occur between harvesting and consumption |
| Relevance of food security efforts to extension | - Positions extension to help households to enhance their<br>agricultural production for own consumption<br>- Positions extension to enhance households' capacity to produce for profit |
| Assessment of extension's effectiveness in contributing to food security and the relevant factors | - Extension's effectiveness is not at its optimum<br>- Poor soft skills for extension<br>- Poor extension services<br>- Poor facilities for extension<br>- Inadequate number of extension practitioners<br>- Inadequate production facilities and infrastructure for households<br>- Extension not trained in farm management skills<br>- Absence of seed banks in rural areas |

In their assessment of food security in the country, the food security managers noted that rural households have limited access to production assets, including good extension services; hence their productivity is very low. The stipend they receive as social grants is therefore spent to acquire food produced by commercial farmers. The respondents strongly identified effective extension as the necessary agency that can improve the quality of rural household farmers to

achieve enhanced productivity. They noted that the current extension in the country cannot bring about the desired change, as it lacks the necessary qualities ranging from soft skills (that is, personal attributes such as good communication ability, sense of humour, leadership quality and teaching capability, etc.) to facilities (such as internet connection, phones, transportation, etc.). They also noted that seed banks (facilities for storage and dissemination of seeds that are indigenous and mostly not sold in the market) need to be established in rural environments to afford household farmers access to environmentally adaptable seeds and thereby reduce their production costs.

***Provincial extension managers***

Four provincial extension managers were interviewed individually to investigate the roles of extension in food security promotion and the challenges facing extension in this regard. Their responses were collectively analysed and are presented in Table 3.

Table 3: Thematic descriptions drawn from interviews with provincial extension managers

| **Thematic analysis** | **Factors identified** |
|---|---|
| Main extension activities that influence household food security | – Visits farms to find solutions to farmers' challenges<br>– Supervises extension projects in communities<br>– Distributes farming inputs to farmers<br>– Relates assistance needs of farmers to the Department<br>– Teaches farmers on crop management<br>– Writes and submits monthly reports to supervisors<br>– Conducts area surveys to profile households for "Sukuma sakhe" (Intervention programme comprising various government departments dealing with rural development) |
| Challenges impacting extension's effectiveness in contributing to household food security | – Inadequate number of extension practitioners<br>– No standard measurement indicators for extension's effectiveness<br>– Poor agricultural education resulting in poorly-trained extension personnel<br>– Dependency creation among households through social grants<br>– Poor image of extension among households<br>– Poor skills and facilities on the path of extension<br>– Dependency creation among farmers, through extension farming for farmers<br>– Poor relationships between academics, extension and NGOs<br>– Governmental beliefs in quantity rather than quality |

Extension managers noted that the government is only interested in the number of rural farmers that are served with production resources (e.g. seeds and fertilizer) to gain political votes, and not whether the resources are put to judicious use. This situation results in the government paying lip service to ensuring

achievement of quality extension service; hence, the reason behind under-funding of extension and its under-staffing. The extension managers also noted that the poor relationship between academics, extension and NGOs affects regular development of extension staff quality in terms of skills updates that correspond with the changing challenges for extension. All of these have resulted in reduced extension activities, mainly to the provision of production resources to farmers and advisory assistance for challenges in crop management.

***Provincial food security managers***

Three provincial food security managers were interviewed to investigate the roles of extension in promoting food security, and the challenges accordingly faced by extension. The responses are summarised in Table 4**.**

Table 4: Thematic descriptions drawn from interviews with provincial food security managers

| **Thematic analysis** | **Factors identified** |
|---|---|
| Functions of extension in food security | – Extension introduces food security agents to households<br>– Extension partakes in food security learning programmes<br>– Extension assists with profiling of poor rural households |
| Challenges facing effective extension delivery | – Enervated attitudes of most extension workers to their duties<br>– Inadequate technical, facilitation and communication skills of extension<br>– Bureaucratic challenges in negotiating for extension's involvement in food security programmes |

The food security section of the Department of Agriculture organises learning programmes around rural communities to train households in selected crop production, dietary quality and food variety mix, and accessing of markets to sell produce. For effective programming in terms of choosing localities and identifying households to invite, public extension is consulted for profiling of

households. The food security managers noted that extension personnel are outsourced from NGOs for the training exercises, rather than making use of the public extension officers. They attributed this decision and practice to their lack of confidence in the quality of technical and soft skills possessed by the public extension officers and also to bureaucratic challenges (that is, the usual unresponsive attitude of extension managers to previous requests for extension support and the unnecessary delays that this might cause) in bargaining for public extension's support.

***Extension field agents***

Twenty-five extension field agents were individually interviewed. Each respondent was initially requested to give his/her perception of food security. They were subsequently asked about their perceptions of: the causes of household food insecurity; the primary functions of extension to combat insecurity; effective extension approaches; the important rural stakeholders for effective extension delivery; and the challenges facing effective extension delivery.

Most extension officers could define food security, but were unable to contextualise its various dynamics when translating this into practical strategies to achieving it. The dominant view is that extension's role is limited to facilitation of household food production. Table 5 summarises the responses according to the three main themes.

Table 5: Thematic descriptions drawn from interviews with field extension field agents

| **Identified themes** | **Factors and perceptions** |
|---|---|
| Perceived causes of food insecurity | - Household/community level factors like: *HIV/AIDS, teenage pregnancy, laziness among households, poor social capital, inadequate production resources, lawlessness, poor rural facilities, and over-reliance on governmental support including social grants*<br>- Land redistribution failure<br>- Country-wide unemployment |
| Extension's primary functions | - Provision of technical production information<br>- Technology transfer to farmers<br>- Relate farmers' challenges to authorities for necessary assistance |
| Effective extension approaches | - Individual education<br>- Commodity-group approach<br>- Programmed extension approach<br>- Needs-driven support services<br>- White farmers mentorship |
| Important rural stakeholders | - Rural old women<br>- Rural leaders |
| Factors affecting extension service delivery | - Extension and management factors, including*: indistinct and inconsistent vision for extension; non-agriculturally skilled leadership; inadequate skills, facilities and number of extension practitioners; poor extension image; extension farming for farmers; deprivation of scholarship opportunities; poor leadership at the Provincial Department; extension activities focusing on project identification and supervision; extension required to attend many meetings; and poor relationships among academics, extension and NGOs*<br>- Governmental factors including: *Poor collaboration and coordination among departments; top-down approach of interventions; dependency creation through support facilities; poor agricultural education in schools; and Governmental belief in quantity rather than quality*<br>- Household/community level factors, including: "*Laziness*" *among households, political interest conflicts occasionally resulting in poor support from rural leaders; lawlessness among rural people, unstructured rural layouts, poor rural education; and households' excessive reliance on social grants* |

Surprisingly, extension officers did not perceive their services as being significantly important in determining households' food security statuses, as they only and mainly noted household/community level factors and governmental factors as the causes of household food insecurity. They noted that governmental social grants are resulting in 'laziness' among rural households to the extent that many households are not prepared to be economically active for a living, particularly through farming. Furthermore, where households are involved in farming, teenage pregnancies and HIV/AIDS reduces the available man-power.

In addition, extension officers noted that extension is unable to become significantly involved in food security initiatives due to poor collaboration and coordination within the Department of Agriculture. In addition, they identified various factors some of which are related to management, under-resourcefulness and poor technical skills of extension, and occasionally poor cooperation from rural leaders and their communities due to political interest conflicts with the incumbent governmental party.

***Private food security/extension providers***

Three respondents collectively from two private organisations dealing with food security and extension services were interviewed. Interview questions covered their assessment of extension's role in achieving household food security and their perception of the challenges facing extension in promoting household food security. Responses were analysed accordingly, with resulting themes and results shown in Table 6.

Table 6: Thematic descriptions drawn from interviews with private food security/extension providers

| **Thematic analysis** | **Identified factors** |
|---|---|
| Extension's role in achieving household food security | - Extension only distributes farming inputs, such as seeds and fertilizers, during planting seasons<br>- Extension promotes mono-cropping<br>- Extension promotes unsustainable uses of scarce natural resources |
| Challenges facing extension regarding household food security promotion | - Extension-related challenges include: e*xtension's disconnection from current agricultural trends and research; poor extension skills to secure farmers' confidence in their technical capability; unavailability of extension when needed for consultation; unsuitable extension approaches; poor communication skills among extension officers; and poor facilitation of extension.*<br>- Government-related factors, namely: *poor understanding of food security by governments; wrong intervention programmes; huge social grants' budget as against lower budget for developmental programmes; and poor market structure that prevents new entrants*<br>- Household-related factors include: "*laziness" among rural households; and increased households' reliance on social grants* |

The private food security/extension providers perceive public extension as being ineffective in service delivery. They attributed this situation to poor management and inadequate technical and soft skills of extension, poor perception of food security by the government which informs funding misplacement for social support rather than developmental programmes to improve household food security, and lack of will to significantly engage in agriculture by households.

***Farmers***

Eight farmers were individually engaged to investigate their perceptions about extension, functions of extensions to them and their perceived challenges to extension. Responses were analysed accordingly and results are presented in Table 7.

Table 7: Thematic descriptions drawn from interviews with farmers

| **Thematic analysis** | **Identified factors** |
|---|---|
| Depicting statements on perceptions about extension | - Some extension practitioners "have poor attitude to work"<br>- Extension practitioners are "trying, but not too much"<br>- Extension practitioners "do not have solutions to our farm problems sometimes"<br>- "We don't see them around mostly when we need them"<br>- Extension practitioners "don't help us for grants"<br>- Extension practitioners "don't listen to us, they just come with their plans" |
| Functions of extension | - Extension helps establish community gardens<br>- Extension offers production advice<br>- Extension provides production resources, such as water tanks and fertilizer |
| Challenges facing extension | - Extension has poor technical and managerial skills<br>- Extension's population is insufficient<br>- Extension uses top-down approaches<br>- Poor resources for extension activities |

Farmers perceive extension as not engaging enough with them in their service delivery. They noted that extension agents are top-down in their approach, as they often visit them with a pre-planned agenda and motives that often do not

address their needs (technical, financial and moral support). They further submitted that the population of the frontline extension is insufficient to cover the diverse and sparsely distributed farmer population.

## Discussion

This study is the first of its kind to specifically investigate the role of extension in promoting household food security in the KZN province of South Africa. The findings and the discussion centre on two themes: extension's current contribution to household food security, and the factors influencing the effectiveness of the delivery of extension services with respect to household food security in the province. Many of the results obtained were anticipated; however, rather surprising contradictions and gaps were also discovered.

### *Extension's current contribution to household food security*

Extension operates within a particular context that influences its activities and actions. Understanding this context is critical to evaluating extension's contribution to food security. The study found that food insecurity is mostly experienced among rural households that generally have inadequate access to infrastructure, productive assets, including extension services and employment opportunities. It also found that many of these households are challenged with a high prevalence of HIV/AIDS, teenage pregnancies and poor social capital. These findings are consistent with those of previous studies (Singini & van Rooyen, 1995; Machethe, 2004; Worth, 2006; Aliber, 2009; & Barrett, 2010). These conditions qualify the households for social grants, a large percentage of which is spent on commercially produced food products, noted as "tiger brands" by a national food security manager. Altman *et al.* (2009) submit that "rural households spend more on food but less per person than their urban counterparts". It is within this complex setting that extension is expected to make contributions to households for food security.

The study found that extension activities include providing technical production information, establishing community gardens, technology transfer and conveying farmers' challenges to the provincial Department of Agriculture for possible assistance. These activities are consistent with the dominance of the technology-centred approach noted by Worth (2006), and the arguments posited by Duvel (2001) and van Rooyen (2001), that solutions to farming challenges in South Africa would be found by developing technologies based on farmers' needs. Innovations are said to be transferred in a people-centred way (through participatory methods), but with focus on overcoming barriers inhibiting adoption and adapting technologies to local circumstances (Duvel, 2001). However, training in participatory methods is mostly non-existent among South African extension practitioners (Worth, 2006, citing Stevens & Treurnicht, 2001).

The national extension manager confirmed that the Norms and Standard document is based on the principle of a "Participatory Programmed Extension Approach" which is consistent with the claim of Crase, Dollery and Worthington (1999) that development in South Africa prioritizes a people-centred approach. Needs-based and deficit-based extension interventions result in dependency, contrary to a people-centred extension approach which, if implemented in compliance with its operational principles, develops farmers through their available assets and by building on indigenous strengths and capacities (Kretzmann & McKnight, 1993; Ngomane, 2010). Extension interventions need to shift from being merely informative to being transformative, from adoption to learning (Worth 2002; 2006). There is a sizeable gap between the intent of extension policy and the reality of extension delivery, attention to which is urgent if extension is to be effective in contributing to household food security.

The results show that the current extension activities promote mono-cropping which has a known tendency to erode soil. Torquebiau, Dosso, Nakaggwa and Philippon (2012: 314), from a study done in KZN on landscape maintenance, submit that: "*The absence of extension services so far has probably played an important role in maintaining the landscape in its current form. Farmers tend to copy existing practices. This does not mean that extension is not*

*desirable, but it should be targeting the right ecological agriculture practices, not just any agricultural intensification*." Thus, any effort to resuscitate extension as an effective means for both agricultural development and household food security must necessarily include ensuring that extension policy and practice are aligned with "the right ecological practices".

Recent job descriptions and definitions of extension have transcended the basic services currently provided by extension in KZN. Extension is defined as "*systems that facilitate the access of farmers, their organizations and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agribusiness and the relevant institutions; and assist them to develop their own technical, organizational and management skills and practices*" (Christoplos, 2010:3). The current public extension approach needs to be urgently re-examined and amended for it to be relevant in the context of the present-day challenges of food insecurity and farmer empowerment. For such reconsideration to address the present challenges with farming in KZN and South Africa generally, Worth (2012) warns that the underlying principle must not be based on challenging the generally perceived duality of the agricultural landscape, as was the case when developing the current 'Norms and Standards for Agricultural Extension and Advisory Services', according to the national extension manager. Worth (2012: ix), however, argues that the duality perception as a concept:

> "…homogenises a much more complex reality with a great diversity of agricultural systems and people – a continuum of farmers and farming. Duality was politically entrenched and led to separate extension services for white and black farmers as a part of the programme against black peasant farmers ever advancing beyond surplus farming and State protection of white farmers and providing them with incentives to progress in farming. While it is important to remove the realities of this duality, duality should not be the mainspring for planning agricultural transformation, development and extension; the danger of focussing on duality as the problem limits the scope, range and nature of responses required to ensure that South African farmers and its agriculture advance equitably into the future."

***Factors affecting extension delivery with respect to household food security***

The front-line extension agents noted ambiguity in job descriptions for extension in the province. They perceive the extension service as lacking distinct focuses which greatly impact on its effectiveness. This may be the consequence of the non-comprehensiveness of the current extension policy, as stated by the national extension manager. Policy is very important as it specifies and prioritises services to be delivered by extension. It provides an official base for instituting government-based extension, its funding mechanisms and the extent of inter-institutional links it establishes and maintains with relevant organizations (Birmingham, 1999).

With reference to household food security, extension's role can range from technology and innovation transfer, human capital development and social capital development, to facilitating small-scale farmers' access to markets (Abdu-Raheem & Worth, 2011). In this context, for extension to be fully effective in promoting household food security, extension policy should be such that it enshrines food security as an important and prioritised extension objective.

The results also highlighted some challenges with the management of extension in KZN. Extension agents complain that their ineffectiveness to promote household food security is a consequence of the poor direction received from the leadership in the provincial Agricultural Department, who are often non-agriculturally trained. This submission echoes the findings of Düvel (2003) who, from the assessment of management efficiency of extension in the Northern (Limpopo) and the North West Provinces of South Africa, submits that: "only about 4 per cent of all managers are classified as very good. What further contributes to the gloomy picture is that the efficiency significantly decreases with increasing rank or seniority." The impact of management cannot be overemphasized relative to extension's effectiveness. This suggests that the criteria used to appoint extension's managers should be re-evaluated to include possession of managerial skills and, perhaps, agricultural training prior to making any new appointments, and that the current extension managers be trained through

in-service programmes on agriculture. Extension can only significantly influence household food security if there are good managerial directives that consistently and effectively direct the frontline extension agents.

In addition to addressing extension management issues, infrastructure for extension also needs to be improved. Extension agents complained of inadequacy of reliable transportation, computer and internet access and telephone facilities. Extension cannot be productive without such support, particularly given the large scale of their clientele, and the complex household/community level circumstances in which they work. These deficiencies confirm the study results by Murphy and Bruening (2006) regarding extension in the Limpopo province of South Africa, upon which they assert: "without efforts made to address this issue, Extension's value to the farmers will likely diminish".

The system of remuneration, reward and incentive should also be revisited. Some extension agents complained of being deprived of scholarship opportunities for further education by their superiors. This may be discouraging, particularly for hardworking and results-oriented agents. Birmingham (1998) noted that terms for promotions, salary increases, awards, rewards and career prospects should be made very clear and be based on merits related to delivery on an appropriate job description, rather than just years of experience and academic records.

Rural socio-economic characteristics, such as those cited earlier, also constitute great challenges. For example, as household agricultural production requires active labour, an HIV or AIDS infected individual is frequently indisposed to working due to weakness or illness, thereby compromising not only household income (Sibanda, Kalibwani & Kureya, 2007), but household food security status as well. Although some of these factors fall outside the control of extension, they must be contextualized and adequately factored into planning processes and strategies for extension services. They constitute additional challenges to extension, as much as they pose greater challenges to intra-household resource management dynamics, particularly in terms of labour, decision-making, and access to productive assets, technologies and agricultural services (FAO, 2004). Therefore, it is important that extension investigates and

understands factors and issues that determine the dynamics of household resource management, most especially in terms of food security. Extension, apart from facilitating household production, can help households to diversify into other agricultural-related businesses such as processing, providing households with nutritional information and best preparation techniques of their food, as well as guiding them towards the nutritional requirements of categories of household members. Paying adequate attention to household dynamics and the underlying factors can help reinforce extension agents' knowledge of the diverse client groups and their constrictions, prospects and requirements, consequently assisting them to assist all groups, including the most underprivileged, towards achieving food security.

While Samson, Lee and Ndlebe *et al.* (2004) and Leibbrandt, Woolard, Finn and Argent (2010) note that social grants significantly promote food security for most poor households, this also demonstrates that households are becoming over-reliant on grants and less inclined or motivated to be actively productive, including in farming and food production. This raises questions about the long-term effect of social grants in their current form. This may explain why households' reliance on social grants has grown significantly from 15% to 73% between 1993 and 2008 (Liebbrandt *et al*., 2010).

The relationship between social grants to poor households in South Africa and the tendency of households to become less motivated to work needs more investigation. Supporting the findings of this study, Bertrand, Mullainathan and Miller (2003) conclude, utilizing cross-sectional statistics, that there is a considerably lower rate of participation in the labour force of prime-aged adults who live with grandparents receiving pensions. Conversely, employing the same data, Posel, Fairburn and Lund (2006) could not establish any significant evidence confirming the labour supply multiplier effect of a social grant. Posel *et al.* note that the submission of Bertrand *et al.* may likely apply to household members who are resident in the same locality as the pensioners, but that these same households significantly tend to have members who may have migrated in search of work or are working elsewhere. Seekings (2007), however, notes that the disincentive to

work or search for employment would likely be more relevant to the unskilled, whose marginal gains from employment are very low.

## Conclusion and recommendation

The study found that extension is generally not very effective on any front in KZN. It found further that it is not making any significant contribution to household food security in the province. Various household/community-level factors, social factors and service delivery factors all inhibit extension from making significant contributions to food security in the province.

This requires two sets of actions. The first is to ensure extension as a service is staffed with appropriately trained personnel, equipped with the necessary tools and resources, and managed and rewarded based on performance against clearly articulate objectives and job descriptions. Appropriate training includes training in all the facets of food security, ranging from facilitating food availability, to food access, food utilisation and food distribution. Second is to establish a single comprehensive policy for both food security and extension, whereby food security is enshrined within extension service delivery, in which extension is clearly directed towards building capacity among farmers (rather than merely transferring technology and delivering government projects), and in which extension is actually accountable to the farmers they serve.

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*CHAPTER 6*

# EXPLORING THE ROLE OF AGRICULTURAL EXTENSION IN PROMOTING BIODIVERSITY CONSERVATION IN KWAZULU-NATAL PROVINCE, SOUTH AFRICA

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## Abstract

Biodiversity conservation outside designated Protected Areas remains challenging in South Africa, where 80% of the biodiversity resources occur on private and communal lands. This applies to the KwaZulu-Natal (KZN) province which is the focus of this study. Landholders logically choose agricultural production ahead of conservation, which they often perform using non-ecological methods. Extension is well positioned to promote ecological agriculture, but its current contribution is unknown. This study examined the role of extension in ecological agriculture in KZN by investigating extension's promotion of ecological agriculture among smallholder farmers, and the factors impacting on their employment of ecologically compatible practices.

Data was collected through semi-structured interviews with 44 respondents, comprising five provincial biodiversity conservation practitioners, one national biodiversity conservation manager, and one national and four provincial agricultural extension managers, selected by purposive sampling; as well as 25 extension officers and eight farmers, selected by convenience sampling.

The study found that extension mainly engages in technology transfer and distribution of production inputs, which poses challenges to biodiversity conservation. Extension shows little concern for biodiversity, and effectively promotes its degradation. Four sets of factors impacting extension's capacity to promote ecological agriculture emerged: household/community-level, governmental, extension management and ecological factors. Key among these were inadequate involvement of youth and men in agriculture; inadequate household production resources; poor collaboration and coordination between extension and biodiversity conservation institutions; top-down extension intervention; poor extension management and delivery capacities; and irregular and inadequate rainfall, as well as droughts and flooding.

The study concluded that there is a need for a clearly articulated extension and biodiversity conservation policy supporting appropriate linkages and better coordination and integration of services among extension and biodiversity agencies within the National and Provincial Departments of Agriculture and with farmers;

more effective agricultural education in schools; strengthening extension support systems; and creating conducive atmospheres for effective extension.

Keywords: Agricultural extension, Biodiversity, Ecological Agriculture, Household

## Introduction

Investment in agriculture, timber production, tourism, fishing, or a blend of all should be considered within biodiversity and ecosystem services' implications (Secretariat of the Convention on Biological Diversity, 2009). Human welfare relies primarily on the diversity of biological resources, its sustainable use and the equitable distribution of its derivable benefits. All too often, the way we organise, control, and govern developmental processes pays little heed to this reality, thereby subjecting biodiversity and the associated ecosystem services to degradation (Abdu-Raheem & Worth, 2013), to a degree that jeopardizes the welfare of the most poor. Changing the status quo for the better is not only achievable, but of paramount importance for the success of this generation and that of the generations to come.

The importance of South Africa's biodiversity wealth is widely acknowledged. The country covers just 2% of the global land area and is home to about 10% of the world's plant species and 7% of birds, mammals and reptiles. It is one of the 17 mega-diverse countries collectively harbouring over two-thirds of the global biodiversity. Three of the world's 25 and eight of Africa's identified hotspots – the Cape Floristic Region, the Succulent Karoo and Maputaland-Pondoland-Albany – are located in South Africa (Driver, Maze & Lombard *et al*., 2004). South Africa ranks 5$^{th}$ in Africa and 24$^{th}$ worldwide in terms of endemic amphibian, mammal, bird and reptile species. The marine biodiversity is also significant, comprising over 10000 species (15% of the global total) (Department of Environmental Affairs and Tourism (DEAT), 2005). In addition, Ezemvelo KwaZulu-Natal Wildlife (EKZNW, n.d) indicates that South Africa's indigenous plant species number about 24000, which is more than double those in Europe and surpasses those in the United States by 6500 species. However, 34% of these South African ecosystems are threatened by land transformation, resulting in 21 ecosystems (5%) being perilously endangered (World Wildlife Fund [WWF], 2008).

South Africa's biodiversity is not evenly distributed across its provinces. The coastal provinces of Eastern Cape, KwaZulu-Natal and Western Cape have the greatest plant diversity, while the Limpopo has the highest mammalian diversity (DEAT, 2005).

This study focuses on KwaZulu-Natal (KZN) province, which hosts over 6000 plant and animal species that mostly do not exist anywhere else in the world. KZN is also comprised of diverse and significant aquatic bodies that are suitable for rich fish fauna (an important food source to the country) and for ecotourism and recreation. An example of the extent of KZN's biodiversity is uKhahlamba Drakensberg Park World Heritage Site, where there exist 2153 known species of plants, 295 bird species, 60 mammal species, 49 reptile species and 26 species of amphibians (EKZNW, n.d).

Approximately 53% of the priority species in KZN are conserved within the network of its Protected Areas (PAs). However, most of the total biodiversity (about 80%) occurs outside the PAs; a condition that necessitates an additional 1.4 million hectares (14.5% of the provincial land) to be put under conservation-compatible uses of land. Biodiversities outside the PAs have been largely degraded and constitute threats to the welfare of people in the province (EKZNW, n.d). In addition, the EKZNW Strategy 2009 – 2014 (EKZNW, 2008:18), citing the Millennium Ecosystem Assessment (2005), noted:

> "The identified direct drivers of biodiversity loss and change in ecosystem services are habitat transformation due to land use change, climate change, invasive alien species, over-exploitation of species, and pollution. The primary drivers of habitat transformation include conversion to agriculture, timber plantations and urbanisation. While the expansion of agriculture and its increased productivity is a success story of enhanced production of one key ecosystem service, this success has come at high and growing costs in terms of trade-offs with other ecosystem services, through the direct impact of land cover change, the release of nutrients into rivers and water withdrawals for irrigation".

It is within this context that agricultural extension operates and, thus, demands that it serve as a viable agent to extend conservation into agricultural lands and agricultural practice; this frames the context of this study.

## Purpose and objectives

The study explored the nature and effectiveness of the contributions of the KwaZulu-Natal public agricultural extension service towards biodiversity conservation on agricultural lands. It examined the roles of extension in ecological agriculture in KZN by investigating the current activities of extension to promote ecological agriculture among smallholder farmers, as well as the factors impacting on smallholder farmers' employing ecologically compatible agricultural practices. From this, conclusions were drawn about what needs to be done to improve the current role of extension in this vital area.

## Methods

Data was collected through semi-structured interviews with 44 respondents. Eleven respondents, comprising five provincial biodiversity conservation practitioners, one national biodiversity conservation manager, four provincial agricultural extension managers, and one national extension manager, were selected by purposive sampling. Twenty-five respondents were public extension officers selected by convenience sampling, and a further eight respondents were farmers also selected by convenience sampling.

Purposive sampling allowed for selecting "information rich" respondents (Patton, 1990: 169), with specific characteristics relevant to the objectives of this research (Silverman, 2010). Convenience sampling allowed for selecting respondents from a relatively homogenous population (Saunders, Lewis and Thornhill, 2007), who were available and willing to participate at the time of data collection (Onwuegbuzie & Leech, 2007). Convenience sampling was suitable as

respondents were sparsely distributed and difficult to track down, coupled with an anticipated low response rate to questionnaires and the limited financial resources of the researcher. Sample size was not pre-determined, but based on the principle of saturation (Glaser & Strauss, 1967); hence, the researcher continued investigations until no new insights were gained from additional interviews.

Informed consent was obtained from each participant prior to data collection. The face and content validity of the interview questions was done with the assistance of experts from the disciplines of Agricultural Extension and Environmental Hydrology sections of the University of KwaZulu-Natal, South Africa. Re-wording and re-structuring of the questions followed suggestions and recommendations from the reviewers. All data collection took place between September, 2011 and September, 2012).

Interviews began with the national and provincial managers for both extension and biodiversity conservation and were done in venues convenient to the respondents. These were followed by the interviews with the field extension agents and farmers. The researcher exploited the opportunities of on-going Extension Recovery and Food Security programmes to interview the field extension agents and farmers. General invitations were given to all participants in the programmes, and those who responded were interviewed. To overcome some respondents' reluctance to participate, the researcher occasionally tried to make the interview process more casual by asking questions while walking together.

Notes were taken during each interview and discussions were simultaneously recorded for further review and crosschecking. The questions were purposefully varied in wording to suit the English proficiency of individual respondents. Participants were given ample time to respond and, where necessary, to elaborate on answers. Responses were probed with follow-up questions to clarify responses and to evoke more detail. Reviewing and analysing of the data was done continuously alongside data collection. Post-interview clarifications of unclear responses were further sought through follow-up telephonic interviews.

Policy and operational documents relevant to the study were examined using content analysis, as they contained qualitative text data (Hsieh & Shannon, 2005). Content analysis allowed for focusing on language-uses in the texts for contextual interpretations (Tesch, 1990) and gaining background knowledge and understanding (Downe-Wamboldt, 1992) relative to the concepts under investigation.

## Results

The results are presented by respondent category and by thematic categorisation of the interview questions. Due to the qualitative nature of the study, representative quotations from respondents are included to enhance the depth of understanding and to clarify points.

### *National extension manager*

The respondent was questioned regarding two key issues: the suitability of the national extension policy to encourage extension's supports for ecological agriculture in South Africa; and a general evaluation of the agricultural extension system in the country. The respondent was unable to effectively answer these questions, noting that:

> "*The way the government of South Africa is structured, extension is only happening at the provincial level…the implementation of the national extension strategies and evaluation of extension activities in relation to other sectors can only be done at the provinces…. At the national office, we only engage in developing and recommending policies, frameworks and approaches to guide on how to go about extension services in the provinces*".

Regarding the policy support for extension to promote ecological agriculture, the respondent explained that:

*"The government of South Africa recognizes that we don't have a lot of good lands for agriculture and the environment must be protected to secure [sic] good future for the coming generations of South Africans, and that is why the Norms and Standard stipulates that extension [must] provide information that promotes sustainable agriculture to farmers".*

***National biodiversity manager***

The respondent was asked about the appropriateness of the current policy in regard to conserving biodiversity on private and communal lands, the factors perceived to be major drivers of biodiversity loss, and the participation of extension in the biodiversity efforts.

The respondent indicated that South Africa recognises the fact that about 50% of its biodiversity resources exist on private and communal lands. It is for this reason that South Africa is part of the agreement reached at the 2003 World Parks Congress, that the global reserve system be expanded to lands outside officially designated PAs in order to prevent important biodiversity loss. Furthermore, the respondent identified factors, including habitat change through agriculture, invasive alien species, climate change, pollution and over-extraction of natural resources as major drivers of biodiversity loss. It was also noted that conservation on private and communal lands is mainly conceived in terms of official arrangements with landholders under stewardship agreements with certain tax incentives. In the words of the respondent:

*"We have biodiversity stewardship programmes which focus on the communities to encourage them to conserve biodiversity on their lands. For this purpose, we've got [sic] stewardship framework, policy document[sic], and we've also developed incentives (tax incentives) … if they conserve their lands, they are eligible for tax incentives… but the communities mostly don't know about these incentives, the tools and the sophistication of what we've developed; they only deal with their everyday subsistence farming. And I don't think extension officers are interested in promoting good resource management practice along [with] their farming technology transfer."*

***Provincial biodiversity conservation practitioners***

Respondents in this category were asked questions relating to the milestones reached with respect to biodiversity conservation on farmlands and the current role of extension in these. They were also questioned about the importance of biodiversity to farmlands.

There have been some successes achieved with conserving biodiversity on private and communal lands that are primarily not used for agricultural purposes. However, a wide gap was noted to exist with conservation on agricultural lands. One respondent noted:

> *"While Ezemvelo's mandate is biodiversity conservation, which can be land-hungry in some cases, our conservation priority areas try as far as possible to avoid high agricultural potential [lands]. We do this by creating a virtual cost surface which in essence makes high agric potential lands more "expensive" and as such the software will try as far as possible to reach those conservation goals and targets elsewhere, in order to not have a conflict between food provision and conservation, given the importance of both. So regarding the involvement of extension with biodiversity, not as far as I know since I have been working with Ezemvelo KZN Wildlife 5 years ago".*

A second participant stated:

> *"There is [sic] some institutional arrangements with the Environmental wing of the DAEA, but the Agriculture side involve us very infrequently. In essence, the only time any arrangements are instituted is when the application to till land is large enough to warrant an EIA or a Basic Assessment report. There are various triggers which may also be considered for the transformation of virgin land, but the most common one is the size in ha that the applicant wished to till".*

A third respondent submitted:

> *"We have [sic] conservation plan in the province wherein we run analyses of the whole province to determine areas which have biodiversity importance and we set conservation targets for different species, like*

*endangered and threatened species … and we take into consideration other land use demands like agriculture, mining, and human habitation. So the software clips those areas for conservation use and other lands can be used for agriculture and whatever uses. This is how we strike a balance in this province, and even in the country as a whole, to make sure we apportion our lands according to the competitive land uses. So we do not work with the agricultural sector or extension agents because our goals are quite different"*.

A fourth respondent similarly noted:

*"The Ezemvelo KZNW has different conservation plans for different terrains of land. When biodiversity occurs on communal or private lands, we negotiate with the owners – whether the chief, the farmer – … to set aside that particular piece of land for conservation because of particular endangered species … and the other surrounding lands can be used for habitation or agriculture. Remember it is a (sic) wrong attitude to just think about what you can make of an environment alone and not what you can give back to it. It is not a question that I must make money, but I must make money responsibly. But we try as much as possible to do conservation on lands that still remain in their pristine states, and avoid agricultural lands"*.

Regarding the importance of biodiversity to farmland, uses such as pollination activities, good pasture provision, pest control, soil fertility enhancement and climate regulation were identified.

One respondent stated:

*"There is a bat species which we are very concerned about, and which sugar cane farmers share our concern for since they prey on the Aldana worm. This is an ecosystem service that this bat is providing to the farmer for free, but some land use changes tend to unwittingly persecute bats. Once that bat is lost within the system (or as we refer to it as the ecosystem matrix), the farmers will need to spend large amounts of money to provide the same effect as those bats"*.

A second respondent noted:

> *"Wetlands not only trap sediment, but also nitrates and phosphates, provide a storm water attenuation service, and are host to a large amount of frogs which prey on pest insects. What is more is they provide breeding grounds for cranes, who [sic] eat the bulbs of Cyperus species, a well-known weed to most farmers trying to curb and eradicate the weed. Cranes provide that service for pasture farmers".*

However, there are concerns that farmers generally do not value the importance of biodiversity and the ecosystem it provides. A respondent stated:

> *"One of the challenges we have faced is making people aware of the costs associated with these environmental goods and services which ecosystems provide for free, hence why we ask for buffers to these natural systems to make them sustainable in the long term".*

***Provincial extension managers***

The respondents were asked questions relating to the roles of extension in the province and its involvement in biodiversity conservation, particularly in relation to providing advice on agricultural practices. Respondents indicated that extension's role is to '*help farmers to help themselves*'. In addition, extension is meant to assist subsistence and small-scale farmers with advice, capacity building, supply of farming resources like seeds and fertilizers, while the commercial farmers are to be assisted with linkages to market and agribusiness opportunities.

Respondents clearly noted that extension does not contribute to biodiversity conservation efforts because it falls outside extension's mandate. Furthermore, the different sections of the Department of Agriculture, Forestry and Fisheries (DAFF) do not hold joint meetings to coordinate independent efforts in realising their overall goals and objectives. Relative to promoting ecological agriculture, one of the respondents observed: '*how can I ask a hungry man not to produce with fertilizers or pesticides*? *That will be unfair*'. Another respondent noted: '*I just do what the MEC ask [sic] us to do*'. These statements indicate that policy, structure and implementation systems within the Department responsible

for agricultural development and environmental conservation do not bring the two essential and interlinked processes together in terms of institutional support; the extension management has no incentive to engage outside its mandate and perceives conservation efforts as irrelevant to their job description. This would, of course, cascade downward into the extension agents in the frontline.

***Frontline extension officers***

The frontline extension officers were queried essentially around two themes: their roles in promoting ecological agriculture; and the factors perceived to be hindering their contribution to ecologically conscious agriculture.

In terms of the roles of extension in ecological agricultural systems and practices, no specific role was identified by the respondents. Rather, they indicated that their extension interventions generally promoted monoculture practices and the use of external inputs such as inorganic chemical fertilisers, pesticides and herbicides.

The respondents identified three key factors inhibiting effective contributions by extension to ecological agricultural practices: governmental factors; extension management factors; and household/community factors.

Government factors were effectively policy issues, including the top-down approach to extension interventions, politically-driven extension activities (e.g. quantity versus quality), the promotion of the use of external farm inputs (including, in some cases, the distribution of inputs at no or subsidised cost), and the promotion of mono-cropping (as a result of commodity focused extension and development planning). The respondents also identified, as another inhibiting factor, the lack of real interest on the part of the government in indigenous farming systems and crops. Also, the practical factor of gaps between policy and implementation further inhibits extension from contributing to conservation conscious agricultural practice.

The respondents identified two broad areas related to extension management factors. First was the knowledge and skill set of the cadre of extension practitioners. Respondents indicated that the level of knowledge and skills in ecological agriculture is inadequate. They also indicated that some extension agents are doubtful or otherwise unconvinced regarding the efficacy and potential of ecological agriculture. On a practical level, the respondents indicated that an inadequate number of frontline extension workers and poor working resources for extension (e.g. budget constraints) are additional factors inhibiting extension's involvement in promoting ecological agriculture.

The household/community factors identified by respondents also fell into two broad categories. Practical inhibitors included poor soils, poor rural layouts to demarcate suitable lands for agricultural purposes from other lands, and inadequate fencing resources to protect cultivated lands from animal intrusion. Additionally, social inhibitors included low levels of education among producers and 'lawlessness'- that is: deliberate defiance of producers to advice from extension agents on grazing or cropping plans on areas of land.

***Farmers***

Farmers were asked to give their perspective on the activities of extension to promote ecological agriculture and the factors which they consider to be an influence on effective practices of ecological agriculture. In terms of the role of extension in promoting ecological agriculture, the respondents confirmed the perception of the extension frontline that extension promotes the use of and supplies external inputs, including hybrid and genetically modified seeds, chemical fertilizers and pesticides.

In terms of the factors hindering successful practice of ecological agriculture, the farmers echoed three areas identified by the extension frontline (government factors, extension management factors, and household community factors) as well as a fourth area, namely, ecological factors.

The governmental factors identified by farmers were all policy-related. These included promoting the use of fertilisers and chemicals, extension support services not being based on farmers' needs (rather, services are driven by government priorities) and the belief in quantity rather than quality of products. They also noted as inhibiting factors, the top-down approach used by government and poor motivation for indigenous cropping systems and seeds.

The extension management factors identified by farmers were low technical skills about natural resource management of extension agents, the insufficient population of field extension officers and inadequate working resources, like vehicles.

Social factors dominated the household/community factors inhibiting ecological agriculture. These included endemic HIV/AIDS and teenage pregnancies and the low involvement levels of youth and men in agriculture, poor rural education resulting in low levels of capability among farmers, emigration from rural areas, high poverty levels and the 'laziness' of some farmers. The farmer respondents also identified practical factors, including inadequate land, poor fencing facilities and poor rural environment layout as inhibiting factors.

Ecological factors identified by the farmer respondents included seasonal and irregular rainfall, flooding, poor soil, drought, pests and disease outbreaks. They indicated the difficulty in not applying chemical fertilisers and pesticides when they lack technical knowledge on biological means of control of pests and diseases. More importantly, having access to adequate water for good plant growth is also a challenge.

Some of the farmers also confirmed the point raised by the extension frontline that some extension workers are not convinced of the viability of ecological agriculture. They also noted that some extension staff do 'lack belief' in biodiversity and ecosystem-compatible methods of farming. Some of the farmers who try to avoid using chemical fertilisers on their farms noted that:

- *"Extension don't like African farming, they tell you to throw your seeds"*
- *"Extension officers just come with their styles, they don't want to listen"*

- *"Extension people are wrong because they tell us to apply manure but they give us fertiliser and chemical[s]"*
- *"Extension must give us fences … we don't like poisons"*

## Discussion

This study is the first of its kind to specifically investigate the role of extension in promoting biodiversity conservation in the KZN province of South Africa. The findings and the discussion centre on three themes: the role of extension in biodiversity conservation, perception differences of farmers and extension regarding indigenous farming practice culture, and factors hindering promotion of ecological agriculture by extension. Many of the results obtained were anticipated; however, rather surprising contradictions and gaps were also discovered.

### *Role of extension in biodiversity conservation*

Despite the fact that land transformation for agriculture contributes to biodiversity degradation, the study found that extension is not contributing in any practical way to guide farmers away from practices that result in degradation and eventual loss of biodiversity and ecosystem services. Although promotion of "sustainable (including conservation of natural resources) agriculture" is identified within the job descriptions for extension by the Norms and Standard for Extension and Advisory Services in Agriculture (Department of Agriculture, 2005: 3), the findings of this study show that extension is disoriented from promoting sustainable farming practices among farmers.

Furthermore, this study shows that there is both a policy and practical disconnection between the biodiversity and conservation objectives and the focus of South Africa's public extension service. Extension is governed by a top-down process that effectively promotes, to all categories of farmers, monoculture,

commercial seeds, chemical fertilisers and pesticides to secure fast growth and high yields without explicit reference to potential degradation of the very natural agricultural resources they require for production. This finding confirms similar findings of Rother, Hall and London (2008), that South African emerging farmers are generally pressured to gaining commercial standing by engaging in high-input production which relies on heavy pesticide usage. This reality is exacerbated by the fact that many registered pesticides and other pesticides used in South Africa have been banned in many other countries as a result of their toxic effects on the welfare of both humans and wildlife (WWF, 2008).

The study found that not only does extension actively promote the use of conventional farming with non-ecologically compatible chemicals, it also actively discourages reliance on or the development of local knowledge, indigenous farming practices and local seed protection and use. The extension message is compounded and reinforced through government-supplied farming inputs, including hybrid and genetically modified seeds, chemical fertilisers and pesticides produced by multi-national companies and being given to small-scale farmers. This serves to erode indigenous farming practices that rely on indigenous seeds and local knowledge. Farmers are taught to be reliant on external sources for inputs which often come at high costs that are practically unaffordable to many poor farming households. In a context in which the presence of extension often pushes farmers towards conventional agriculture, it is not surprising that Torquebiau, Dosso, Nakaggwa and Philippon (2012: 314) remarked in their findings from a study that examined the factors responsible for a well-balanced landscape in an area in KwaZulu-Natal, South Africa, that: "The absence of extension services so far has probably played an important role in maintaining the landscape in its current form. Farmers tend to copy existing practices. This does not mean that extension is not desirable, but it should be targeting the right ecological agriculture practices, not just any agricultural intensification."

***Perception differences of farmers and extension regarding indigenous farming practice culture***

Farmers indicated that indigenous farming culture is being diminished by the loss of agricultural lands to erosion, the lack of interest among youth in agriculture, increasing emigration to urban centres, 'laziness' of some farmers and increasingly unfavourable weather patterns. In contrast, extension agents regarded these same factors as reasons for farmers to abandon traditional/indigenous methods and use external farming inputs and conventional production systems. The perception of extension viewed the impact of conventional agricultural systems on biodiversity and ecosystem services as secondary to overcoming poverty and food insecurity for rural farming households. As a result, natural resource management is often not included in extension intervention planning.

The ideology underlining the perception of frontline extension agents is contrary to the intention of the newly-proposed national-level extension policy which seeks to: "establish a policy framework within which services to farmers, and incentives for them, support wise decision-making about the use of resources for agricultural production" (Worth, 2012: xiv, citing the African National Congress, 1994).

There are clear indications of disconnections between biodiversity conservation objectives and the advice and other practices of extension, at policy, implementation and management levels. To address the situation requires coherency and consistency between the guiding policies for extension and biodiversity conservation. It also requires that extension management and practice should be re-visited and re-oriented, to support and empower farmers in making wise decisions within the context of their environmental and socio-economic situations, in order to produce profitably and in an ecologically compatible manner.

***Factors hindering promotion of ecological agriculture by extension***

The study found that governmental, extension management, ecological and household/community level factors hinder the promotion of ecological agriculture by extension. An examination of each provides insight into what needs to be done to harmonise current extension offerings with the concerns of ecological agriculture.

The current prescriptive, top-down approach to agricultural extension adopted by the South African government promotes mono-cropping systems and the use of external inputs. This highlights the need to review and ultimately put in place policies that will recognise the interconnectedness of agricultural extension and biodiversity conservation and provide a means for the practical integration of the two vital functions. While the current framework for extension services includes the promotion of sustainable agricultural practices and current conservation policy states the need to protect biodiversity resources with an emphasis on private and communal lands, practical connections do not exist between agencies responsible for these goals. This lack of a working relationship is a major inhibitor to meeting the objectives of both policies.

An example of this is an incident recently reported, of the KwaZulu-Natal extension agents who misled farmers into ploughing hectares of virgin grasslands in contravention of the Conservation of Agricultural Resources Act (CARA), without obtaining the required environmental authorisation. According to Coan (2011: n. p), "Permits were issued by the national Department of Agriculture for a total of 3876 hectares, 579 of which are situated in irreplaceable mist-belt grassland and the majority in sensitive biodiversity areas. Alarmingly, 65% of the applications for which Cara permits were granted, fall within "Biodiversity Priority 1 areas…. in some cases the biodiversity and ecosystem importance of the areas applied for (and in some cases already ploughed), were known to both the landowner and the agricultural extension officer, as permits had been applied for the same areas in the past and were either withdrawn or denied environmental authorisation on account of the critical biodiversity and ecosystem issues" (Coan,

2011: n.p). To address the practical disconnection of policy and implementation within the public sector, Coan (2011: n.p) stresses that: "…farmers require both an agricultural and an environmental permit before they can cultivate and in so doing achieve a sustainable balance between crop production and maintaining our natural heritage."

One challenge of this disconnection is that the conventional principles underlining private land conservation programmes often position conservation agencies as sole custodians of conservation goals, with landholders serving only as programme adopters (Siikamäki & Layton, 2007). This approach reflects the prevailing top-down governance bargains and increases the possibility for disconnection between promoters of biodiversity conservation and landholders, regarding biodiversity conservation objectives. This, in turn, lays the foundation for failure of the collaboration exercise where, "landholders perceive themselves as political outsiders (because) the rhetoric … has assumed an elitist form that fails to ground itself in local cultural practice" (Peterson & Horton, 1995: 141).

It should be possible to simultaneously realise the goals of agricultural production and nature conservation. However, to achieve coherence, the two processes need to be reconnected in policy and practice; at policy level and on the ground.

In terms of extension management, in the context of government's agenda to improve productivity and profitability, farmers should be afforded relevant, regular and unprejudiced advice on how to harness their local knowledge (including their landrace seeds) for sustainable farming. This should include improving knowledge and conservation literacy among farmers which will enhance the probability of collective action among farmers to employ ecological agriculture practices (Perotti & Wildcat, 2000).

Furthermore, extension agents must have the knowledge and skills to support and give advice on farming practices that are compatible with ecological agriculture. Similarly, extension policy – covering both objectives and extension management – must reinforce extension working in support of ecological

agriculture. Finally, extension services must be tailored to support farmers' adoption of ecological agriculture and be adequately resourced to pursue such an intervention.

The study found that ecological factors such as irregularity of rainfall, drought, flooding, diseases, pest outbreaks and poor soil quality also impact on households' engagement in ecological agriculture. This is mainly due to the lack, or low level, of technical knowledge among farmers to address ecological situations in a biological (ecologically compatible) way. The only management method they are exposed to by extension agents is the use of chemicals.

For their part, most extension officers lack the necessary skills to promote low carbon approaches and other biological options that replace the use of farming inputs and suit the ecological conditions of small-scale farmers. This is, in part, a consequence of biased tertiary agricultural training in South Africa towards 'industrial and high-input agriculture' that encourages farmers to use genetically modified crops and hybrid seeds and chemicals (Wynberg, van Niekerk, Williams & Mkhaliphi, 2012:8). To address this, the training of extension agents – including those currently deployed and those still in training – in ecological agriculture must be investigated and revamped to ensure that they acquire the relevant knowledge, skills and attitudes to simultaneously promote profitable and ecologically sound farming. In addition, extension agents must be fortified with working resources, such as reliable transportation, computer and Internet access, and telephone facilities for easy accessibility and in order to stay connected with the world of research that can keep them abreast of new, ecologically compatible practices and technologies. Finally, the monitoring and evaluation systems used to govern extension intervention and manage individual performance also need to be reviewed and adjusted to ensure that promoting ecological agricultural practices is rewarded.

Household and community factors such as the endemism of HIV/AIDS, teenage pregnancies, poor rural environment layouts, 'laziness' of some farmers, poor rural education resulting in low understanding capabilities among farmers, low involvement levels of youth and men in agriculture, inadequate lands, poor

fencing facilities, high poverty levels and out-migration of youth, have all been identified as factors affecting engagement in ecological agriculture. Ecological agriculture is labour consuming. While the detrimental effect of HIV/AIDS on ecological agricultural practice, through labour withdrawal from farms, has been established (Barnett, Tumushabe & Bantebya, 1995), it is logical to conclude that the other factors identified in this study have a similar deleterious effect.

The one exception may be the level of education. Research conducted in Sri Lanka indicated that the level of education does not affect adoption of the ecological practice of intercropping (Iqbal, Ireland & Rodrigo, 2006). However, Asiabaka and Owens (2002) found that personal characteristics of farmers, including level of education, do affect adoption behaviour.

Although most of these factors are generally not under the control of households or extension, understanding how they influence ecological agriculture is necessary for extension agents to identify befitting entry points and methods to promote ecologically compatible farming practices.

## Conclusion and recommendation

The study found that there is a disconnection between policy and practice in extension and biodiversity conservation that opens the door to natural resource degradation. The gap exists as a result of divergent policies, lack of collaboration (both in structure and in daily practice), and lack of adequate training of frontline extension agents to promote biodiversity conservation in the context of productive and profitable farming.

Factors relating to government and its functionality protocols, extension management, household/community characteristics and ecological patterns, were also found to be key factors inhibiting extension from promoting ecologically sound agriculture among smallholder farmers. Collectively, these factors render extension incapable to countermand the existing lack of such knowledge, skills

and attitudes among smallholder farmers to address real ecological issues which they face daily as farmers.

This study therefore recommends that policy be revisited; meta-policy integrating extension and biodiversity conservation is required. As clearly articulated, this includes extension policy that enables extension to plan and implement extension interventions which promote biodiversity conservation in the context of productive and profitable farming. It also recommends that there be better collaboration and coordination among extension and biodiversity conservation institutions and between these agencies and landholders, farmers and communities.

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*CHAPTER 7*

# MODELLING EFFECTIVE AND SIMULTANEOUS PROMOTION OF FOOD SECURITY AND BIODIVERSITY CONSERVATION THROUGH AGRICULTURAL EXTENSION ACTIVITIES

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## Abstract

There is no doubt that public agricultural extension has contributed to the success of South Africa's current large-scale farmers, the fruit of which the nation still enjoys. Nonetheless, the ineffectiveness of the extension service to meet the current challenges – particularly among resource-challenged, small-holder farmers – is widely acknowledged. This ineffectiveness extends to promoting household food security within the context of encouraging biodiversity conservation on farm lands. To examine this, this paper draws on recently conducted research to sketch the current model within which extension pursues these seemingly dichotomous objectives and identifies some gaps which, if addressed, can enable extension to simultaneously meet these two objectives. The paper presents a refurbished extension model which builds on the current South African model by introducing three elements: collaboration among all the stakeholders involved in promoting food security, biodiversity conservation and agricultural extension objectives; adopting a capacity-building approach (replacing the current top-down, technology transfer approach) to support farmers who are significant actors in food security and biodiversity agendas; and re-invigorating extension institutions through introducing specific presently lacking capacities. The refurbished model postulates that extension, alongside farmers, would be better placed to foster new farming ideologies to address the food security and biodiversity conservation concerns. Better positioning of farmers, who in themselves are thinkers and problems-solvers, and simultaneous promotion of effective working relationships among related governmental departments will strengthen complementarity, rather than competition and contradiction, which currently hamper methodical and systematic pursuit of the necessarily conjoined objectives of and processes for achieving food security and conserving biodiversity.

Keywords: Extension model, agricultural extension, food security, biodiversity conservation

## Introduction

This paper originates from a study investigating the role of agricultural extension in promoting food security, within the context of encouraging biodiversity conservation. Research by Abdu-Raheem and Worth (Chapters 5 & 6) identified four sets of factors -- household/community-level, social, ecological and service delivery , which impact public extension's capacity to simultaneously promote food security and biodiversity conservation in the KwaZulu-Natal province of South Africa. Key among these factors were: inadequate household production resources (including a lack of seed banks); poor education; over-reliance on social grants; inadequate involvement of youth and men in agriculture; inadequate and irregular rainfall; the top-down nature of food security and extension interventions; poor collaboration and coordination among extension, researchers, NGOs and government departments; as well as poor extension policy and capacity. This paper thus seeks to critique the current system within which extension is situated to perform its duties and to propose a refined model for sustainable extension, which can enhance sustainable promotion of food security and biodiversity conservation.

Agricultural extension has changed in definition and purpose over time. Recently, extension has been defined as "systems that facilitate the access of farmers, the organization and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agribusiness, and other relevant institutions; and assist them to develop their own technical, organizational and management skills and practices" (Christoplos, 2010:3). This definition suggests that the relevance of extension moves beyond the traditional transfer of information, knowledge and technology from researchers to farmers, to include developing capacity, skills and effective management techniques among farmers and farming communities. On both the national and provincial scales in South Africa, extension has fallen short of this definition and has not had its intended impact (Abdu-Raheem & Worth, Chapters 5 & 6).

Constitutionally, extension provision is a provincial competency, while the National Department of Agriculture only determines the policies and funding resources. The Norms and Standards for Agricultural Extension and Advisory Services document (Department of Agriculture, 2005) challenges extension to improve household food security through agricultural-based activities, within the broad context of sustainability. In KwaZulu-Natal, extension has been working towards this goal through technology transfer to farmers and promoting the use of external farm inputs such as seeds, fertilizers and chemical pesticides and herbicides (Abdu-Raheem & Worth, Chapters 5 & 6); a system that is clearly unsustainable.

Housed within the KwaZulu-Natal Department of Agriculture are separate sections directly charged with food security and biodiversity conservation programmes. The food security division promotes food security by distributing food packs in schools and encouraging household agricultural production, food diversification, household income, food distribution and improved nutritional status among households. These are implemented through projects which are delivered by contracted service providers with specific technical capacities. In practice, those responsible for these projects do not engage with public extension officers, citing that they have no working relationship with the extension division and that there is a lack of relevant skills and capacities among extension personnel (Abdu-Raheem & Worth, Chapter 5).

Ezemvelo KwaZulu-Natal Wildlife (EKZNW) is the agency empowered to carry out conservation activities within the province. The EKZNW agency forges partnerships with landowners under various conservation agreements. The agreement most relevant to this study is the Biodiversity Stewardship Programme. Under this programme, partnerships are based entirely on terms set by the EKZNW agency-- a situation which can potentially create a disconnection between landowners and the EKZNW agency regarding conservation goals, thereby compromising success. Unless and until landowners are mutually engaged to determine the terms and are satisfied by the agreements, the exercise is bound to fail (Mayer & Tikka, 2006).

## The current model for agricultural extension

Figure 1 depicts the operational model in which extension is currently expected to promote food security and biodiversity conservation. It shows that for 'poor households' and 'farmers' (the focus of state interventions in food security), extension and biodiversity conservation target the three main goals of their livelihood activities: income, food and social status.

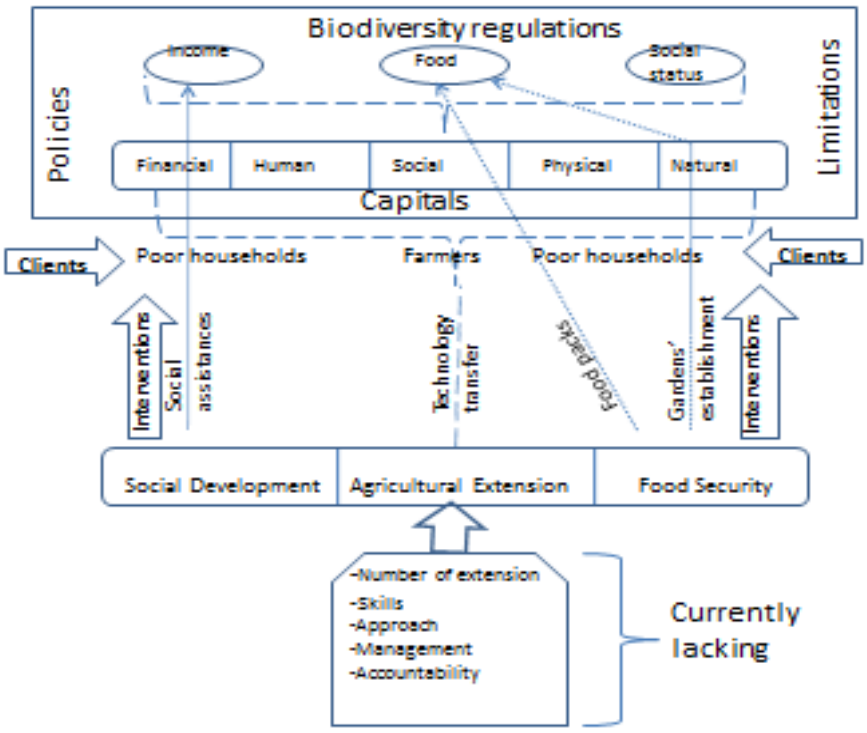


Figure1: Current model for extension to promote food security and biodiversity conservation

These goals are pursued through actively combining five stocks of capital: financial; human; social; physical and natural (Putnam, Leonardi & Nanetti, 1993; Daily, 1997; Pretty, 1998; Pretty & Ward, 2000). Financial capital refers to the economic base or access to money, which could be in the form of income, grants, remittances, subsidies, pensions, credit facilities or savings. Human capital refers to the condition of an individual, including knowledge, skills, health, nutrition and education; the access to the resources affecting these conditions, such as schools

and hospitals; and the capability to harness these resources for livelihood purposes. Social capital comprises the interpersonal relationships with others in the community; the rules, norms and values against which behaviour is measured and the general social traditions and practices shaping cohesiveness and connectedness within communities. Physical capital encompasses the general infrastructure on the farm and is found within the farmers' communities, such as buildings, electricity or energy-sources, market facilities, communication facilities and transportation systems. Natural capital includes the available biodiversity and ecosystem services, ranging from land, food, water supply, wood, biological pest control, plant pollination, wildlife habitats, soil formation, nutrient fixation and recycling, climate regulation, to flood control and water regulation relating to leisure and recreational values.

Encasing the livelihood goals and capitals are policies and regulations which provide directions, opportunities, standards and limitations to livelihood activities. In this context, they include agricultural policy, trade and other economic policies, biodiversity regulations and legislation, food security strategy, and the extension Norms and Standards, among others.

Feeding into the mix of policy, capitals and goals are the key state interventions offered by Social Development, Agricultural Extension and Food Security, respectively. Social Development assists qualifying households, including poor farmers, to achieve their income needs by augmenting their financial capital through grants, pensions and other instruments. While support is reported to have effectively contributed to poverty reduction and enhancement of education and health status (Woolard, Hartggen & Klasen, 2010), caution is required as its sustainability is questionable in the face of the perpetually increasing costs of maintaining it (Case & Deaton, 1998). In addition, Abdu-Raheem and Worth (Chapter 5) found out that households tend to be over-reliant on social grants and lose the incentive to engage in productive livelihood activities, such as farming. To address this situation, this study suggests that social grants be linked to creating sustainable livelihood opportunities, including farming.

The current model, as depicted in Figure 1, includes Food Security structures as one of the intervening actors assisting poor households to achieve food security. Food Security augments the social and natural capital available to households in the execution of its programmes. It provides food through public schools and helps to establish home gardens and potential community markets for their produce. In this way, it impacts the use of biodiversity resources within households.

The current model also depicts Agricultural Extension as a third intervening actor; it engages all five forms of capital assets available to farmers to pursue their livelihood goals. The intention is that farmers would be assisted to optimally combine and sustainably harness their various capitals to achieve their goals, while leaving adequate stocks for future generations. If these capitals are exploited unsustainably, their depletion may or may not allow the current generation to fulfil their goals, but jeopardises the livelihood opportunities of the future generation.

As also depicted in Figure 1, compounding the situation are the institutional factors that affect agricultural extension, as well as food security sectors, in the efficient and effective discharge of their mandates. These include the number of officials implementing intervention programmes, the skills, approach and methods adopted for interventions and the overall institutional managements of the intervening bodies – all of which are currently lacking and thus inhibiting extension's capacity to carry out its mandate.

## The challenge of the refurbished extension model

The model presented in Figure 2 identifies three elements to refurbish the existing model for agricultural extension, in order to position it to achieve food security objectives within biodiversity conservation consciousness. The model proposes that: genuine bilateral and multi-lateral collaboration be established between agricultural extension and governmental sectors concerned with food

security and biodiversity conservation; agricultural extension be scaled-up in terms of the lack of resources currently hampering its effectiveness; and, to achieve food security and biodiversity conservation goals, extension adopts a capacity-building approach with farmers and rural families, to replace, or at least augment, the current single-mode, top-down technology transfer method.

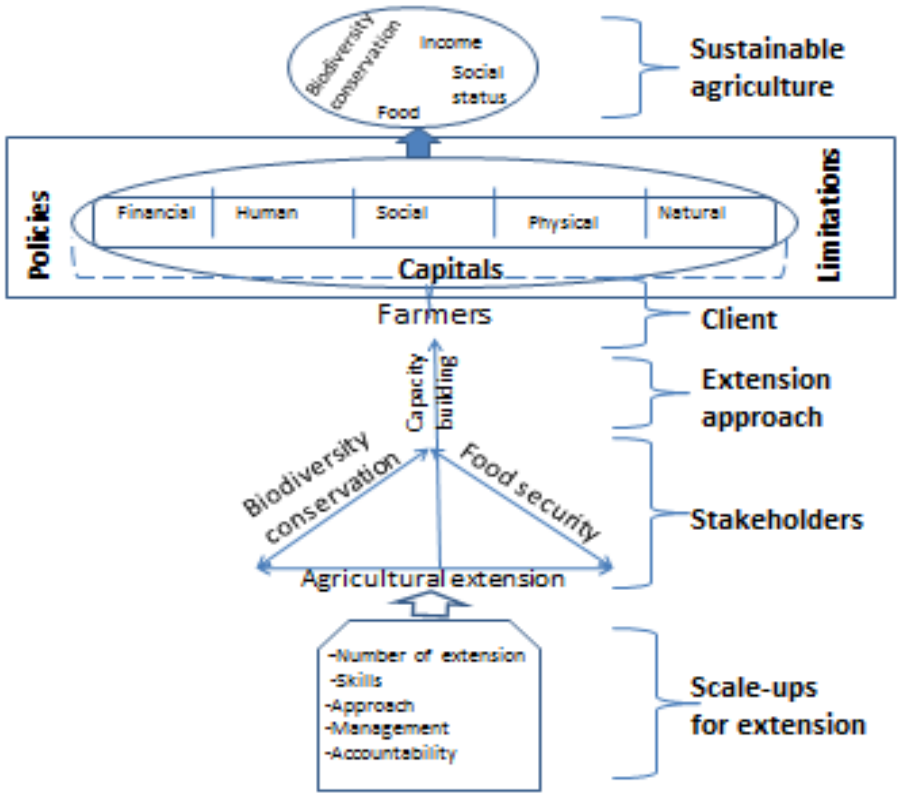


Figure 2: Refurbished extension model to promote food security and biodiversity conservation

The refurbished model suggests creating coherent and collaborative networks in terms of institutions and processes among and within the various governmental departments that are, at the present, individually pursuing goals related to food security and biodiversity conservation. Also embedded in the model is 'policy coherence' – be it termed coherent policy-making, policy integration, policy coordination, joined-up government coherence or holistic government – which is essential to the successful implementation of programmes,

particularly when they have overlapping processes and outcomes (Geerling & Stead, 2003; Duraiappah & Bhardwaj, 2007). Such policy coherence is most appropriately defined as "a pursuit of coherence, consistency, comprehensiveness and of harmonious compatible outcomes" (Challis, Fuller, Henwood *et al.*, 1988: 25). Such policy coherence anticipates "the systematic promotion of mutually reinforcing policies across government departments and agencies creating synergies towards achieving the defined objective" (Duraiappah & Bhardwaj, 2007:3, citing DAC, 2001). Thus, to be effective, policies must be "coordinated, consistent, complementary and not contradictory" (Dunn & Mondesire, 2002). These are particularly applicable in the national context within which extension, biodiversity conservation and food security operate in South Africa.

Policy coherence can be applied along vertical and horizontal dimensions, where vertical scale applies across a number of spatial or organizational levels and horizontal is along a single level (Briassoulis, 2004). Vertical and horizontal coherences also embrace institutional and organizational coherence and coherence between instruments (that is, processes or devices employed by government, corporate bodies or persons to realise anticipated outcomes) (Duraiappah, 2004). Organizational coherence encompasses coordination between organizations, such as ministries at the national level. Institutional coherence involves synergism and reduces disagreements amid various rules, formal and informal, of 'separate' organizations (Duraiappah, 2004).

Alongside vertical and horizontal coherencies is the need for inter-territorial and intra-sectorial integration which must occur not only, in this instance, between different governmental levels, but must also include horizontal integration which occurs between sectors within a single organization with multiple mandates and operational units. Inter-territorial integration further applies between authorities sharing the same resources and intra-sectorial integration applies among various sections within a department of an organization (Geerling & Stead, 2003).

Among the various dimensions of policy coherence are some key points of convergence: integration at the scale of actors implementing various policies;

carefully planned coordination at the level of procedures, management, resources and instruments employed among sectors pursuing common goals; and integration at the level of targets, ambitions and goals pursued by various actors, without making compromises. It is this degree of policy coherence that is envisaged in the refurbished extension model and would apply to all the policies, institutions and processes, as well as the full complement of actors (including farmers) involved in achieving biodiversity conservation and food security objectives.

The model further stresses that extension institutions should be strengthened with required capacities to facilitate their efforts and activities. The National Department of Agriculture, Forestry and Fisheries (DAFF, 2011: 1) noted that: "beneficiaries of government interventions invariably identified extension and advisory service as the weak link militating against the full impact of government agricultural programmes". Specifically in KwaZulu-Natal, a number of factors conspire against effective performance of extension in the province, among which are: inadequate numbers of extension compared to the number of people served; poor knowledge and skills among extension staff; poor management of extension; lack of accountability of extension to farmers; and poor remuneration of extension staff (Abdu-Raheem & Worth, Chapters 5 & 6). Some of these issues appear to have equally been recognized by the national Department of Agriculture, Forestry and Fisheries (DAFF); the response to which prompted DAFF to launch an "Extension Recovery Programme" in 2011, the goal of which was to generally improve the quality of extension services throughout South Africa. Five pillars serve as the crux of the programme, namely to:

- *Ensure visibility and accountability of extension*: This pillar intends to redeem the image and relevance of extension to farmers, by training extension officers with necessary skills and equipping them with working materials, like digital pens and record books to keep logs of contact sessions with farmers. The record book is envisaged to enhance extension's accessibility to his/her clients' recorded information, while the digital pen facilitates communication of information to a central database.

- *Promote professionalism and the image of extension*: This focuses on facilitating extension to become active members of relevant professional bodies, whereby they can have access to scientific and/or position papers and equally gain from presented scientific findings.

- *Recruit extension personnel*: This is a commitment on the path of the DAFF to scale-up the number of front-line extension officers in ratios 1:400, 1:500 and 1:500 of extension against small-scale crop farmers, extension against small-scale livestock farmers and extension against small-scale mixed farm farmers, respectively. In this respect, provinces are required to meet these ratios by employing more extension personnel who meet prescribed educational standards, and accordingly, assist them to build capacity in order to meet intended provincial growth and development targets.

- *Re-skill and re-orientate extension workers:* This is intended to train (through short courses and internal training) current extension officers in knowledge and skills, as prescribed in the Norms and Standards for Extension. Further to this, extension officers who lack the necessary qualifications are being encouraged to upgrade these and are offered financial aid to do so.

- *Provide ICT infrastructure and other resources:* This is to provide extension officers with relevant technologies, such as computers, Internet facilities and connection to Internet-based extension knowledge and information sharing systems, with particular reference to 'Extension Suite Online'.

In addition to the processes of the Extension Recovery Programme, there is an on-going process of creating a national policy for extension to provide effective frameworks that will enhance achievement of the goals set for extension delivery. At the time of writing, the new policy had been drafted and submitted

for approval. Its main thrusts are to create policy and operational coherence among agriculture, forestry and fishery units at national and provincial levels and to refocus extension to being on the farmer, taking into account the vast diversity that is contained in the sector.

The refurbished model also suggests that the extension approach be broadened from the exclusive use of traditional technology transfer to focusing on building the capacities of farmers, as problem solvers and technology innovators engaged in and applying sustainable agricultural and conservation practices. Agricultural extension needs to decide whether its aim is to develop production itself or more specifically, the actors involved in production (Worth, 2002). To develop production, technology transfer aptly fits; developing farmers' capacity seems better achieved with a capacity-building approach. This implies that whichever objective is chosen, it must be clearly articulated and supported by the most appropriate strategy. While in its policy pronouncements South Africa prioritises development through capacity building (Crase, Dollery & Worthington, 1999), implying the aim of developing the actors, practice on the ground is clearly production orientated, supported by technology transfer extension programming.

Farming in a sustainable manner is both knowledge intensive (Lawrence & Garforth, 1997) and information demanding compared to conventional methods, because skills effectively take the place of external inputs (Lawrence & Garforth, 1997; Pretty, 1995; Cho & Boland, 2004). In essence, the roles of knowledge, information, technologies, skills and attitudes in sustainable agriculture cannot be over-stated (World Bank, 2006) and sustainable farming would necessarily be best supported by extension through implementing programmes aimed at building capacity among farmers.

There have been varying scholarly opinions regarding the positions of farmers in a learning model. While perceptions exist that farmers are partners in extension (Duvel, 2000), they are equally seen as mere recipients of extension activities (Petheram, 1998). Aligning with the perception that farmers are recipients of extension, Schuh (2000) argued that it is the education from extension that suitably positions farmers to make effective use of their resources.

Following the opinion of farmers as partners in extension, Roberts, Couts, Ayers and Bilston (2002) argue that farmers' indigenous knowledge is only enhanced in a learning process.

The refurbished model would work well within the framework of farmers as co-learners or partners; in which case, the partnership proposed to support capacity building in the model envisages that:

- indigenous solutions are developed to tackle local problems while promoting social unity (Uphoff, 1996);
- common objectives and goals be set among actors, with a sense of achieving economies of scale and ownership (Castillo, 1997);
- there will be complementarities of efforts and skills based on comparative advantages of actors, as opposed to competition among them, to bring about efficiency (Zeigler & Hossain, 1995);
- replication of efforts is minimized among actors, while opportunities exist to access outside knowledge and resources to solve composite problems (Fesenmaier & Contractor, 2001);
- farming households achieve lasting benefits in terms of independence, self-management, autonomy and assuring structure of self-organization (Kibwana, 2000);
- asymmetry of information is reduced, thereby giving way to the birthing of new knowledge (Koza & Lewin, 2000); and
- access to harmonized competencies and specialized talent is enhanced, such that creates novel markets and suppliers (Carayannis, Alexander & Ioannidis, 2000).

## Conclusion

The ineffectiveness of extension to drive or otherwise contribute meaningfully to the achievement of South African goals for agriculture, food security and biodiversity conservation is apparent. While development policy clearly articulates the objectives, operational policy, implementation frameworks and the existing modes of delivery are unable to deliver them. This study documented the current working model within which extension is expected to drive food security objectives of households, as well as on-farm biodiversity conservation. An interrogation of the model identified critical gaps and disconnections that render the overall model ineffective. Key among these were: lack of collaboration among all the stakeholders involved in promoting food security, biodiversity conservation objectives and agricultural extension objectives; lack of adoption of capacity- building approach (replacing the current top-down, technology transfer approach) by extension to support farmers who are at the centre of the food security and biodiversity objectives; and weak extension institutions due to inadequacy of capacities that are essential for successful extension delivery. Drawing on the responses of key respondents in all three sectors – extension, food security and biodiversity conservation – the study proposes the refurbished extension model.

While continuing to work within the livelihood paradigms of farmers and rural families, the refurbished model defines a more logical structuring of service delivery mechanisms supported by policy coherence and the adoption of more appropriate extension methods to revitalize extension within the set context of achieving food security and biodiversity conservation simultaneously. The model suggests institutionalised and structured collaboration among all the stakeholders and institutions on the policy and processes fronts, in order to bring about complementarities and consistencies in efforts to achieve crosscutting objectives.

Specifically, the model suggests substituting, or at least augmenting, the current top-down, technology transfer approach of extension with a learning-based approach that focuses on building capacity among farmers and rural

families to address their farming and food security in the context of the principles of biodiversity conservation. The capacity to be built, based on an assessment of farmers' strengths and weaknesses, is essentially in the arena of problem-solving through farmer-led, on-farm scientific enquiry, with an emphasis on generating local solutions and knowledge, with minimum reliance on external state support, be it extension or other state agencies.

The study cautions, however, that for the refurbished model to be effective, extension structures must be provided with sufficient staff members who have the appropriate knowledge and skills. They must also have adequate resources and be supported by accountable management personnel and processes – all of which are currently lacking.

The model ultimately submits that, rather than extension focusing all its attention and efforts on the outcomes (food security and biodiversity conservation), it should concentrate on facilitating change within the actors (farmers, rural families and at all levels in the extension service) in terms of skills, knowledge, attitudes and behaviour. Building such capacity will ultimately lead to the realisation of the desired outcomes.

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# *CHAPTER 8*

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the overall account of the iterative processes involved in this study, which broadly investigated the current roles that agricultural extension plays in promoting food security and biodiversity conservation among small-scale rural farmers in the KwaZulu-Natal (KZN) province of South Africa. The specific questions addressed in the study were:

a. What is food security?
b. What is biodiversity conservation?
c. What is the role of agricultural extension in promoting food security?
d. What is the role of agricultural extension in promoting biodiversity conservation?
e. What is the role of extension in simultaneously promoting food security and biodiversity conservation?
f. What factors limit/affect the capacity of extension in simultaneously promoting food security and biodiversity conservation?

Through this investigation in one of South Africa's key agricultural provinces, one of South Africa's most biologically diverse provinces, and equally one of South Africa's most food insecure provinces – it is hoped that some insights can be gained to enable the work of other extension systems, biodiversity agents and food security programmes to integrate more effectively. It is further hoped that through this study, extension agencies will have a clearer understanding of how they can organize and implement their extension programmes and engagements with farmers to promote effective food security in the context of biodiversity conservation, and, where relevant, to promote biodiversity conservation in the context of food security.

## Definitions of variables

The theoretical framework for this study consists of three variables: food security; biodiversity conservation; and agricultural extension. The study contextualized these variables in the light of some established definitions in the literature. *Food security* is thus defined as "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2010:8).

Also in this study, *biodiversity* is defined as the disparity among genes, species and ecosystems, and variation in organization, role and composition at each of these cadres (Biggs, Reyers & Scholes, 2006, citing Noss, 1990). Finally, *extension* is defined as "systems that facilitate the access of farmers, their organizations and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agribusiness and the relevant institutions; and assist them to develop their own technical, organizational and management skills and practices" (Christoplos, 2010: 3).

To accommodate these variables as the framework for the investigation, this study made use of an interdependency approach; that food security, biodiversity conservation and agricultural extension are all linked to one another. To answer the specific questions highlighted above, this chapter reconciles the findings from the theoretical investigations in Chapters 2, 3 and 4 with the findings from Chapter 5 and 6 and the inductive conclusions in Chapter 7. The general findings of this study are summarised under four broad themes:

- Extension in the context of food security;
- Extension in the context of biodiversity conservation;
- Factors affecting extension to drive food security and biodiversity conservation simultaneously; and
- Reconciling food security and biodiversity conservation in the context of extension intervention.

## Extension in the context of food security

As noted in Chapter 2, South Africa is nationally food secure. As also stated in Chapter 2, the current production and export patterns in South Africa relative to agricultural production would suggest that all households are food secure. However, contrary to this expectation, vulnerability to food insecurity in the country is estimated at around 14 per cent; which leaves almost 25 per cent of children below six years of age exposed to malnutrition and consequent stunted growth (Human Sciences Research Council [HSRC], 2004). The context of the study, therefore, is the entrenched food insecurity which is endemic to rural areas worldwide, including South Africa, due to high poverty conditions. This condition places achieving household food security in the priority list of governmental concerns in South Africa, with the challenge directed at agricultural extension to redeem the situation, in the context of enhancing household agricultural production. This responsibility aligns very well with one of the primary objectives of extension, as stated in its definition above.

The literature reviewed in this study points out that for extension to be effective with its intervention, it needs to understand the integrated socio-cultural and economic contexts of the food insecure households, within the broader circumstance of available livelihood opportunities they (can) use to overcome their food shortages. In this regard, Chapter 2 identifies poor households as using one or combinations of five 'pathways' to cope with their poverty and food insecurity challenges: an agricultural pathway; a multiple-activity pathway; an assistance pathway; an exit pathway and a micro-enterprise pathway.

These pathways provide agricultural extension opportunities to influence household food security. Figure 1 in Chapter 2 presents a model to demonstrate that, by focusing on enhancing agricultural productivity and profitability (through the agricultural path option), all the other pathways available to rural households can be equally enhanced. In this model, extension is envisaged to be flexible, as situations warrant, in the use of one or combinations of its dynamic approaches -

technology transfer, advisory, facilitation, and learning - to influence the agricultural pathway. The chief instruments identified as being readily at the disposal of extension to influence the agricultural path include technology transfer and innovation, human capital development, social capital development and increasing market access.

Contrary to these identified broad influences of extension, to be able to enhance rural household food security, results from empirical investigation in the KZN province (Chapter 4) showed extension's activities as being restricted to consist primarily of technology transfer and provision of advisory services. None of the extension managers and the field extension staff interviewed described extension's job as including human capital development, social capital enhancement or market access facilitation, as suggested in literature. This represents a sizeable gap between extension theory and its practice in KZN/South Africa.

South African agricultural extension has a long history in technology knowledge transfer. There could have been rationalisation for this singular approach of extension delivery in the former governmental dispensation as extension, then, was largely focused on assisting established commercial farmers. However, with the current re-focussing of extension to support emerging and smallholder farmers, there is a strong need for extension objectives and modalities of operation to be re-visited. As discussed in Chapter 5, ample evidence exists that the technology transfer approach alone has not and cannot bring about the intended development in household food security. Even where it has been successful in terms of food production, as in India's so called 'green revolution', that success negatively impacted rural existence (Suri, 2005). The adoption of technology transfer in India as the sole approach to combat the widespread food scarcity was carelessly thought through and lacked foresight. This single-track approach led to the erosion of the long-existing social capital that had previously provided a socio-cultural safety net among rural producers.

Learning from India's and others' lessons, extension in South Africa needs to grow beyond promoting increased household agricultural production through transfer of technology, to developing farming households as critical thinkers, problem-solvers and to assist them identify and/or develop alternative livelihood opportunities within their local set-ups. This will assist poor farming households to contribute to, and equally benefit from, their rural economies, and facilitate their access and entitlements to food. This study challenges extension to adopt a livelihoods framework approach to intervention activities, facilitating participatory stock-taking of households' assets and identifying vulnerabilities to generate solutions that are compatible, comprehensive and cost-effective within the context of the farmers' households and farming systems.

## Extension in the context of biodiversity conservation

Biodiversity conservation, particularly on communal and rural farmlands, is still of great concern in South Africa. As discussed in Chapter 3, agriculture is a major contributor to the degradation of rural environments if it is practiced unsustainably; and, thus, constitutes a major challenge to biodiversity conservation. The chapter presented a model - Figure 1 - that suggests how extension can successfully incorporate biodiversity conservation into its vision and practice. The model, through assumption that instruments of social mobilization, education, indigenous knowledge facilitation, linkages and on-going advisory services are at the disposal of agricultural extension, demonstrates the capacity of extension to effectively address the biodiversity conservation concerns at community level. The chapter further posits that, by focusing on enhancing sustainable agricultural practices through the above-mentioned instruments, biodiversity conservation; increased household agricultural production and income; and improved social capital and human capital can be simultaneously achieved through extension.

However, the reality of extension's contributions to biodiversity conservation in the KZN province (Chapter 6) is contradictory to the submissions

about good extension practice and support from literature. The study, as discussed in Chapter 6, found that extension mainly engages in technology transfer and distribution of external production inputs; the very practices numerously cited in literature as posing challenges to biodiversity conservation. This extension approach being employed in the KZN province is not consistent with the definitions of extension currently prevalent in literature. Extension is expected to assist farmers in making the best decisions regarding sustainable utilisation of their production assets, through provision of technical and management skills. This is the idea of the biodiversity-compliant farming practices promoted in this study (Chapter 4), which is entrenched in the concept of agricultural diversity - agro-diversity- that is defined as "the many ways in which farmers use the natural diversity of the environment for production, including not only their choice of crops but also their management of land, water and biota as a whole" (Brookfield & Padoch 1994: 9). This concept technically contradicts the very essence of technology transfer and external inputs use promotion that are only aimed at increasing farming outputs without any necessary consideration to cater for the long-term usefulness of such natural diversity assets. Providing the rational for the inconsistency of the technology transfer approach with biodiversity-compliant system of farming, Kaihura and Stocking (2003: 6) assert that: "Since agrodiverse practices are well integrated with local ecosystems and livelihoods, they are site and household specific and cannot simply be copied to other environments, households, or communities. Promotion of these agrodiverse practices cannot be done through the conventional extension model of transfer of technology".

In light of this, for extension interventions to be relevant to the modern day challenges of farming households, particularly with regard to enhancing and sustaining farmers' natural resource capital, extension support needs to be contextualized within the specific socio-cultural and biological conditions of rural household farmers. Support must include encouraging development of local knowledge and technologies (specifically seeds), training on minimum external inputs use, facilitating establishment of local seed banks, and training on

adaptation of seed and general farming practices to the challenges of imminent climate change.

## Factors affecting extension to drive food security and biodiversity conservation simultaneously

A range of factors impacting extension's capacity to promote food security and biodiversity conservation objectives simultaneously emerged in this study (Chapters 5 & 6), which include: household/community-level; governmental; extension management; and ecological factors. Key among these factors include: inadequate involvement of youth and men in agriculture; inadequate household production resources; poor collaboration and coordination between extension and biodiversity conservation institutions; top-down extension intervention; poor extension management and delivery capacities; and irregular and inadequate rainfall, as well as droughts and flooding.

Notwithstanding, and without trivialising the significance of the households/communities, government and ecology factors for effective extension delivery to achieve household food security and biodiversity conservation simultaneously, the chosen focus of this study, relates more to the inhibiting factors that are specifically peculiar to the management and delivery approach of extension itself. It is widely agreed that agricultural extension in South Africa is failing to achieve its intended purposes of driving sustainability in agricultural production, developing skills and capacities among farmers -particularly smallholders- and enhancing poor rural households' (particularly farming families') income. The challenges in extension most commonly cited in this study were: weak extension management; lack of dedication among extension staff; poor visibility and accessibility of extension on the ground; bias of extension support towards the elite and established farmers; poor working resources for extension; and insufficient numbers of extension workers relative to the number of clients requiring service.

Despite the unanimity of voices regarding these challenges, there have been divergent views on the way forward. Some recommend a complete overhauling of the extension system in the country, while others suggest mere reinforcement of the current framework and mode of service delivery. The findings of this study suggest that the former is required. When measured against the yardsticks provided in literature for functional and effective extension, the KZN public sector extension service is woefully lacking. This study suggests that the fundamental dysfunction of the service cannot be corrected through simply investing capital and efforts to reorganise the sector. Furthermore, this study ultimately recommends that in order to become effective in the context of simultaneously promoting food security and biodiversity conservation objectives in KZN and South Africa in general, the extension system requires an all-encompassing reassessment and restructuring, starting with creating coherent policy.

## Reconciling food security and biodiversity conservation in the context of extension intervention

Having argued in Chapter 2 the theory that agricultural extension can contribute to food security by focusing on the agricultural pathway available to rural families and, that extension, through the Extension Vase model proposed in Chapter 3, can also contribute to promoting biodiversity conservation, Chapter 4 of this study submitted that extension should be particularly well positioned to address both food insecurity and biodiversity conservation concerns simultaneously via the Extension Funnel (Figure 1 in Chapter 4). This integrates the instruments of technology transfer and innovation, human capital development, social capital development, market access facilitation, social mobilization, education, indigenous knowledge facilitation, linkages and on-going advisory services. This study however acknowledges that while the depiction of the approach presents it as relatively straightforward, it is a complex process that one should not attempt to over-simplify. It will require deliberate, conscious efforts sustained over time.

Juxtaposing the findings from the literature and the results from the primary research presented in Chapters 5 and 6, it is evident that extension in the KZN province is, in both policy and practice, not able to promote food security in the context of biodiversity conservation. The challenge is fundamental in nature. The current operational policy, implementation framework and mode of extension delivery do not match the explicitly set goals of the development policy of South Africa which, among other things, calls for delivery relating to agricultural production, food security and biodiversity conservation.

In the light of these disconnections, Chapter 7 proposes a refurbished extension model which suggests institutionalised and structured collaboration among all the stakeholders and institutions on the policy and processes fronts, to bring about complementarities and coherence in the efforts to achieve the crosscutting objectives of food security in the context of biodiversity conservation. The model further suggests replacing, or at least augmenting, the current top-down, technology transfer approach of extension with a learning-based approach, with the view of developing self-determining and critically thinking farmers that can generate local technical knowledge and solutions to their farming challenges, with minimum reliance on external, particularly state, support. The study, however, cautions that the refurbished model can only be effective if there are sufficient field extension workers with appropriate knowledge and skills that are bolstered by strong extension support structures, including strong and relevant management and processes, and adequate working resources.

Specifically, this study makes the following recommendations regarding refurbishing the extension system and delivery in the KZN province and, perhaps, in South Africa in general:

1. Extension service delivery must shift from its current comfortable top-down approach to a knowledge sharing and facilitated learning approach. In this case, extension workers regard their clients as partners in

developing new skills, generating innovations and learning about sustainability, rather than assuming the farmers to be mere recipients of externally generated scientific knowledge which may or may not be suited to their livelihoods and farming contexts. Such engagement would lead to a set of farmers who could take command of their individual and collective production, agri-business and related challenges, in terms of identifying them, surveying the resources at their disposal, and generating local, adaptive and creative solutions to them. The 'inward-looking' thus engendered would bolster a deepened understanding of the factors affecting sustainability, and equally help to reduce the use of external inputs that have been shown to have debilitating effects on the biodiversity resources and the ecosystem services they provide.

2. Extension support must be completely entrenched within the livelihoods frameworks of their clients. This would shift the underutilized energies and intellectual wealth of extension agents from focusing solely on primary production activities to a broader extension conversation. This would include exploration of the full spectrum of issues related to production (e.g. marketing, finance, input supply, and organisational capacity) as well as identifying (jointly with their clients) other livelihoods opportunities which can further improve their clients' household food security, including both agricultural and non-agriculturally related livelihoods.

3. Extension should promote social capital among farming households. This will enhance farmers' capacity to manage their farming operations more effectively and efficiently. It will improve the utilisation and effectiveness of the socio-cultural safety nets inherent in rural communities, and it will also improve organizational bargaining strength among the farming communities, strengthening their command over the factors that influence their lives.

4. In all their extension engagements -be they production, food security or livelihood related- extension agents must be grounded thoroughly in both technical and 'soft' (e.g. participatory, learning, and communication) skills to promote environmentally sustainable livelihoods among farmers.

5. Extension support should also encourage rural communities to institutionalize local governing bodies, mechanisms and rules to protect the invaluable natural resources upon which much of their sustenance depends.

6. A single comprehensive policy must be established addressing food security, biodiversity conservation and extension, whereby both food security and conservation objectives are enshrined within extension service delivery.

## Recommendations for further study

A number of questions arise from the findings and conclusions of this study. From Chapter 2, extension is theoretically well-positioned to influence general rural economy by addressing poverty and food insecurity challenges of rural households. This is made evident in the model therein presented. However, insights from the interviews with the research participants, particularly the extension officers, show that extension agents do not perceive themselves as being relevant to improving the welfares of households that are not directly engaged in agriculture. This suggests a great disconnect between the standards set out in literature and the extension in practice, especially in the KZN province. Thus, it will be valuable to investigate if this disconnect exists in other provinces of South Africa, then interrogating the causes of such a disconnection between extension theory, extension practice and perceptions of extension agents, wherever in the country this may occur.

The three models proposed in this study; the "potential influence of agricultural extension on rural household strategies to address poverty and food insecurity" (Chapter 2), the "extension vase for biodiversity conservation" (Chapter 3) and the "extension funnel for sustainable agriculture" (Chapters 4), need to be further interrogated and tested in practice.

The study (Chapters 5 & 6) found that extension officers do not possess the required knowledge and skills concerning enhancing food security and biodiversity conservation simultaneously. However, this finding was of a general nature. Further investigation is needed to establish the specific competencies regarding both food security and biodiversity conservation that need enhancement, and how these can be achieved.

The discussions in Chapters 5, 6 and 7 suggest disconnections between the "Norms and Standards for Extension" (Department of Agriculture, 2005) -the guiding policy document for extension management and service delivery in the country- and the extension implementation framework and mode of service delivery in practice in the KZN. This warrants further investigation. It should be an iterative process through which any disconnections and their causes can be determined and the norms and standards themselves can be validated and/or amended. This can feed into the various adjustments to extension policy and implementation suggested earlier.

One of the most telling indicators of policy and the assumptions upon which policy rests are the budgeting, planning, implementation, monitoring and evaluation (including individual performance evaluation) systems and practices employed to administer public agricultural extension. The findings of this study suggest that these entrenched systems and practices are inconsistent with the frameworks and policy changes recommended in this study. This warrants further investigation to ensure that any policy and process changes are given the relevant practical day-to-day support.

The negative influence of social grants on involvement of rural households in gainful self-employment was raised frequently by the extension agents interviewed for this study. As discussed in Chapter 5, literature is ambivalent on this issue with researchers arguing both sides. Thus, research into this is warranted to determine the influences of various social relief packages on households' dispositions to engage in gainful employment for their livelihoods. This could assist in making more informed decisions on where to direct the bulk of governmental spending between developmental programmes and relief programmes; and in terms of extension, how it would need to adjust its engagement with farmers to accommodate whatever influence social grants do have on the farming families' decision-making processes.

The declining interest in agriculture on the part of youth was raised frequently by the respondents in this study. Some respondents attributed this situation to a perceived lower importance accorded to agricultural subjects in schools. It is also consistent with a commonly held view that agriculture is negatively perceived as a career option. Research into this would help with long term planning of both extension and the offering of agricultural science subjects in schools and tertiary institutions – both of which will have a bearing on the long-term shape of agriculture in South Africa.

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# APPENDICES

## Appendix 1: Ethical Clearance Certificate

UNIVERSITY OF
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INYUVESI
YAKWAZULU-NATALI

Research Office (Govan Mbeki Centre)
Private Bag x54001
DURBAN, 4000
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Fax No: +27 31 260 4609
Ximbap@ukzn.ac.za

14 September 2011

**Mr K A Abdu-Raheem (211552842)**
**School Agricultural Science and Agribusiness**

Dear Mr Abdu-Raheem

**PROTOCOL REFERENCE NUMBER: HSS/0804/011D**
**PROJECT TITLE: A study of the Role of Agricultural Extension in Promoting Food Security in the Context of Encouraging Biodiversity Conservation in South Africa**

**EXPEDITED APPROVAL**

I wish to inform you that your application has been granted Full Approval through an expedited review process:

**Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.**

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....

**Professor Steven Collings (Chair)**
**HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE**

cc. Supervisor – Dr S H Worth
cc. Ms M Francis

# Appendix 2: Consent Form

Dear Experts,

**LETTER AND FORM OF CONSENT**

I am a PhD student in the Department of Agricultural Extension and Rural Resource Management at the University of KwaZulu-Natal, Pietermaritzburg Campus. I invite you to participate in a study I am conducting on 'the role of Agricultural Extension in the promotion of food security in the context of biodiversity conservation in South Africa'. Gathering information on all the aspects of enclosed interview questions will help me understand the perceptions, competencies and training needs of extension officers relative to simultaneous achievement of food security and biodiversity conservation. The findings of the study will be used to make agricultural policy recommendations.

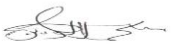
Your participation is voluntary; and your identity and information provided will be kept strictly kept confidential. The data provided by you will be combined and analyzed with those from other participants, and the findings will be reported in a summary form such that individual responses are not identified.

I anticipate that the completion of the interview will take about 45 – 60 minutes of your time. If you agree to participate, please complete and sign the consent form attached.

For further information, you are free to send me an email at: 211552842@ukzn.ac.za
or call me on: 079 346 3070 or 073 259 8469.

Thank you in advance for your assistance and cooperation. The success of the study depends greatly on your cooperation and generous responses to the questions.

Yours Sincerely,



**Kamal A. Abdu-Raheem**

**DECLARATION**

I…… (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF PARTICIPANT DATE

……

# Appendix 3: Letters requesting permission for assistance

***Agricultural Research Council***

Agricultural Extension and Rural Resource Management

UNIVERSITY OF KWAZULU-NATAL

Ref: Abdu-Raheem Intro 2011
Date: 21 November 2011

The Director
Agricultural Research Council

Mr. Kamal Abdu-Raheem: Student Number 211552842

Dear colleague,

This letter confirms that the above-named student is currently conducting research under the aegis of our unit in pursuit of his Doctorate. His area of research is Agricultural Extension. Specifically he is looking at the role of agricultural extension in the simultaneous pursuit of Food Security and Biodiversity Conservation.

To complete his research Mr Abdu-Raheem will be conducting interviews with extension workers, extension managers, and officials and managers working with biodiversity conservation and food security. In addition, he will be reviewing reports and reviews published by government and research institutions.

We kindly request that you assist him in any way possible, particularly by allowing him to have access to staff, managers and relevant documents over which you may have responsibility. All his research is subject to the highest ethical standards as upheld by the University of KwaZulu-Natal.

Should you have any questions or queries, please contact me at your earliest convenience.

Thank you very much for your cooperation.

Kindest regards,

Steven Worth (PhD)
Senior Lecturer
Programme Coordinator:
Agricultural Extension and
Rural Resource Management

Address: Room 53, New Forestry Building, Agric. Avenue, Pietermaritzburg Private Bag X01, Scottsville, 3209
Telephone: +27 (0)33-2605792 Fax: +27 (0)33-2606118 Email: worths@ukzn.ac.za Website: www.ukzn.ac.za/sasa
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

*National Extension Support, DAFF*

UNIVERSITY OF KWAZULU-NATAL

Agricultural Extension and Rural Resource Management

Ref: Abdu-Raheem Intro 2011
Date: 21 November 2011

Ms Lebo Botsheleng
Director: National Extension Support
Department of Agriculture, Fisheries and Forestry

Mr. Kamal Abdu-Raheem: Student Number 211552842

Dear colleague,

This letter confirms that the above-named student is currently conducting research under the aegis of our unit in pursuit of his Doctorate. His area of research is Agricultural Extension. Specifically he is looking at the role of agricultural extension in the simultaneous pursuit of Food Security and Biodiversity Conservation.

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Thank you very much for your cooperation.

Kindest regards,

Steven Worth (PhD)
Senior Lecturer
Programme Coordinator:
Agricultural Extension and
Rural Resource Management

SASA

**Address:** Room 33, New Forestry Building, Agric. Avenue, Pietermaritzburg Private Bag X01, Scottsville, 3209
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Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

***Senior Food Security Officer for Policy Development and Analysis, DAFF***

UNIVERSITY OF KWAZULU-NATAL

Agricultural Extension and Rural Resource Management

Ref: Abdu-Raheem Intro 2011
Date: 21 November 2011

Mrs Dikeledi Kunene
Senior Food Security Officer for Policy Development and Analysis
Department of Agriculture, Forestry and Fisheries

Mr. Kamal Abdu-Raheem: Student Number 211552842

Dear colleague,

This letter confirms that the above-named student is currently conducting research under the aegis of our unit in pursuit of his Doctorate. His area of research is Agricultural Extension. Specifically he is looking at the role of agricultural extension in the simultaneous pursuit of Food Security and Biodiversity Conservation.

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Programme Coordinator:
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Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

***Deputy Manager: Food Security, DAFF***

UNIVERSITY OF KWAZULU-NATAL

Agricultural Extension and Rural Resource Management

Ref: Abdu-Raheem Intro 2011
Date: 21 November 2011

Mr Simbongiseni Ndimande
Deputy Manager: Food Security
Department of Agriculture, Forestry and Fisheries

Mr. Kamal Abdu-Raheem: Student Number 211552842

Dear colleague,

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Senior Lecturer
Programme Coordinator:
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Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

***Land Use and Soil Management: Director, DAFF***

UNIVERSITY OF KWAZULU-NATAL

Agricultural Extension and Rural Resource Management

Ref: Abdu-Raheem Intro 2011
Date: 21 November 2011

Ms Mpumi Ntlokwana
Director: Landuse and Soil Management
Department of Agriculture, Forestry and Fisheries

Mr. Kamal Abdu-Raheem: Student Number 211552842

Dear colleague,

This letter confirms that the above-named student is currently conducting research under the aegis of our unit in pursuit of his Doctorate. His area of research is Agricultural Extension. Specifically he is looking at the role of agricultural extension in the simultaneous pursuit of Food Security and Biodiversity Conservation.

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Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

***SANBI: Director***

UNIVERSITY OF KWAZULU-NATAL

Agricultural Extension and Rural Resource Management

Ref: Abdu-Raheem Intro 2011
Date: 21 November 2011

The Director
SANBI

Mr. Kamal Abdu-Raheem: Student Number 211552842

Dear colleague,

This letter confirms that the above-named student is currently conducting research under the aegis of our unit in pursuit of his Doctorate. His area of research is Agricultural Extension. Specifically he is looking at the role of agricultural extension in the simultaneous pursuit of Food Security and Biodiversity Conservation.

To complete his research Mr Abdu-Raheem will be conducting interviews with extension workers, extension managers, and officials and managers working with biodiversity conservation and food security. In addition, he will be reviewing reports and reviews published by government and research institutions.

We kindly request that you assist him in any way possible, particularly by allowing him to have access to staff, managers and relevant documents over which you may have responsibility. All his research is subject to the highest ethical standards as upheld by the University of KwaZulu-Natal.

Should you have any questions or queries, please contact me at your earliest convenience.

Thank you very much for your cooperation.

Kindest regards,

Steven Worth (PhD)
Senior Lecturer
Programme Coordinator:
Agricultural Extension and
Rural Resource Management

SASA

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## Appendix 4: Interview Guide – Food Security

1. South Africa is noted to be 'nationally' food secure but not universally food secure at household level; how would you describe this scenario of food insecurity in South Africa?
2. In your opinion, how do you think agriculture (particularly smallholder farming) can assist in addressing the current South African food insecurity problem?
3. How would you describe the relationship between agricultural productivity to enhancing food security and biodiversity (and / or other ecosystem services), and how does this vary between agricultural systems?

4. How can the competing demands on land for food production and biodiversity conservation be best balanced to ensure adequate provision of ecosystem services while maintaining adequate yields and prices?

5. What are the advantages and disadvantages of organic production systems in terms of biodiversity, ecosystem services, yield and human health, particularly in South Africa?

6. What is the feasibility (pros, cons, challenges) of designing food production systems that reduce dependence on externally derived nitrogen, phosphorus and potassium resources, especially for smallholder farmers in South Africa?

7. What role can reclamation, restoration and rehabilitation of degraded land play in increasing South Africa's food production?

8. What do you think about increasing both crop and non-crop biodiversity to help in pest and disease management?

9. How can landscape-level (large scale) interventions help pest management and which approaches are currently the most economically and socially sustainable?

10. What impact can crop genetic improvement have on levels of micronutrients available to humans, livestock and fish?

11. How can animal production be made suitable for smallholder South African farmers, in terms of environmental impact, economic return and human food supply, and what should the key government policies be to ensure that a balance between the two is implemented?

12. What are the environmental impacts of different kinds of livestock-rearing and aquaculture systems?

***Food security and the market***

1. Where is food waste greatest in food chains in the South African food chain and what measures can be taken significantly to reduce it?

2. What is the best way to make food chains more resilient to exogenous trends (e.g. the upward price of hydrocarbons) and shocks (e.g. disruption to air freight)?

3. What is the potential contribution of localized food production to the overall sustainability of food systems?

4. What are the best indicators that could be used to define agricultural sustainability thresholds (e.g. soil condition, biodiversity, nutrient cycling, energy use, key biological processes such as pollination) and how might these be communicated through the food chain?

5. What are the best institutional mechanisms to manage food stocks, storage and distribution and entitlement systems to ensure continued and sustainable supplies of food?

6. What priority investments are needed to develop effective input and output markets in South Africa to enhance household food security?

7. As energy prices rise, how can agriculture increase its efficiency and use fewer inputs and fertilizers to become economically sustainable and environmentally sensitive, yet still feed a growing population?

8. What mechanisms can be devised to buffer against growing market volatility and subsequent risk for farmers, and under which conditions do different mechanisms work best?

9. How can market-based food supply systems be developed that offer economically sustainable levels of financial reward to all participants in the food chain (i.e. farmers, processors and retailers), while simultaneously providing safe, nutritious, natural resource-stewarding and affordable food to consumers?

10. What mechanisms will provide incentives for further investment in sustainable, high-yielding agriculture that also maintains ecosystem services?

11. Should the national food security policies be designed to be more compatible with worldwide open market food policies? If yes, how can this be done while securing the interests of local farmers and equitable access to food?

12. Can (or do you think) intervention methods be developed that encourage and provide incentives to all consumers to eat healthy diets?

13. What programmes (or combinations) are most effective in promoting broad-based access to healthy food across different socioeconomic groups?

14. What are the long-term impacts of international donors and aid enterprises on target beneficiaries in terms of food security, environmental sustainability, local economies and social inclusion?

***Synergizing food security with extension and biodiversity conservation***

1. Do you think agricultural extension has been helpful in achieving household food security objectives in South Africa; and to what extent if so?

2. Do you think that extension is failing to actively contribute to enhancement of household food security? If yes, where do you think extension is failing to deliver good services relative to household food security?

3. In your opinion, how can agricultural extension be more integrated into fulfilling household food security objectives if they are to be involved in promoting biodiversity conservation?

4. Do you know of any successful initiative (models) concerning household food security wherein extension is technically involved? And what impacts do these models deliver for them to be judged successful? (Find out more about the models.)

5. What factors make these models positive and successful?

6. Are these models province specific, or do you think they can be replicated in other parts of South Africa?

## Appendix 5: Interview Guide - Farmers

1. Do you agree that soil and water are the sources of all life and should, therefore, be strictly conserved? If yes, why?

2. In your understanding, can you say that the indiscriminate uses of agricultural chemicals are harmful for humans and biodiversity?

3. Apart from chemical fertilizers, what other kinds of fertilizer do you know? And how will you compare them, if any, to chemical fertilizer in terms of yield improvement and soil conservation?

4. What will you say about a statement like this: "The key to agriculture's future success lies in learning to imitate natural ecosystems and farm in harmony with nature"?

5. In your opinion, do you think that the primary goals of farmers should be to only to maximize productivity, efficiency and profitability of their farms?*

6. Will you support that most farms should integrate plant production and animal husbandry? Why?

7. Do you think that crop rotation and crop diversity can reduce farm pests? If yes, in what combination do you think this can be done?

8. Do you agree that minimum tillage can reduce erosion and soil degradation? If yes, do you think this has any effect on the long term success of farming business?

9. If you use animal fertilizer or green manure and practice crop rotation in your farm, instead of using chemical fertilizer and pesticide, do you think your productivity will reduce? *

10. Do you agree that one of the principles of agriculture is to reduce environmental damages?

11. In your understanding, what will you say about 'increase' or 'decrease' of pests attack due to consecutive planting of a crop in a farm?

12. Do you agree that agricultural chemical materials pollute the environment?

13. Do you think that for increased agricultural production, it is compulsory to use machinery and new technologies?*

14. Which one of these options do you think is better for a long-run success of farming: (a) reducing pest and weed damage through chemicals application to farm?* or (b) controlling and reducing damage of farm pests and weeds through biological control?

15. Do you think it is necessary to be using either animal fertilizer or green manure since there is chemical fertilizer?

16. Do you think that residues of chemical fertilizer before planting reduce fertility of the soil?*

17. In your opinion, do you think that crop rotation can cause soil erosion?*

18. Do extension officers talk to you about the dangers of chemical fertilizer?

19. Do extension officers encourage you to try non-chemical fertilizing and weed control on your farms?

20. What roles do extension officer play in helping you to maintain your lands?

## Appendix 6: Interview Guide – Extension Officers

**Introduction:** ***Food security and biodiversity perspectives***

1. South Africa is noted to be 'nationally' food secure but not universally food secure at household level; what is your understanding of food security as an extension officer?

2. Do you think that household food security should be one of the current objectives of South African public extension?

3. How does the public/private agricultural extension influence food security in South Africa? What programmes are initiated by extension to address food security at household level in South Africa?

4. How effective has the public agricultural extension been in promoting food security in South Africa? Achievements and success stories.

5. Agriculture has been accused of posing great environmental threats particularly to biodiversity in terms of its production and management practices; what do you think about this? Do you know of any practical evidence of this?

6. Biodiversity and climate change are factors reported to be affecting South Africa's national food security. If you were to rank by importance factors like: land degradation, increased oil prices, bio-energy needs, food prices, growing population, change in consumer behaviour, etc., where would you place biodiversity and climate change (ranking: very important, less important, not important)? Why?

7. What challenges do you think affect production of sufficient and stable food in a sustainable and environmentally friendly way in South Africa?

8. What do you think are the largest challenges facing biodiversity conservation relative to achieving food security?

***Extension-specific***

1. As agriculture is highly knowledge intensive, what is the effectiveness of different extension strategies and how best can they be set up to facilitate technical innovation, in the context of achieving enhanced food household food security and biodiversity conservation, with the aim of ensuring that the widest number of farmers are reached and engaged?

2. How much can agricultural education, extension, farmer mobilization and empowerment be achieved by the new opportunities afforded by mobile phone and web-based technologies?

3. What are the best social learning and multi-stakeholder models you know of (e.g. farmers field schools) to bring together farmers, researchers, advisors, commercial enterprises, policy makers and other key actors to develop better technologies and institutions, for a more equitable, sustainable and innovative agriculture?

4. What are the best options to improve the sustainable intensification of agriculture? Explain.

5. How can the transition from today's smallholder-based agriculture to sustainable agricultural intensification occur in ways that maintain livelihoods for smallholder farmers?

6. Under what environmental and institutional conditions will increasing agro-biodiversity at farm scale result in increased livelihood opportunities and income?

7. Who will be farming in 2050, and what will their land relationships be (farm ownership, rental or management)?

***Synergies between food security and biodiversity conservation***

There are synergies between increased food production, biodiversity/nature conservation and climate protection. In our understanding, an environmentally-sound food security is based on land use agricultural systems that conserve, safeguard and rebuild ecosystem services. In your opinion and understanding, (do you agree; and why?)

1. Where are the synergies between biodiversity conservation and food security?

2. Is there any success model (for example, agricultural systems, advanced technologies, projects, policy frameworks, etc.) that helps strengthen and/ or build these synergies? Please consider success models in the following areas:
   - Land use systems/ approaches
   - Policy environment
   - Institutional mechanisms
   - Financing mechanisms

3. What 'factors for success' make them positive models?

4. What are the impacts of the success models? (Positive, negative, and all aspects of sustainability).

5. Are these models region specific, or do you feel they can be transferred to other regions within South Africa?

***Chances for improving synergies and benefits***

1. Which of the existing or new strategies, approaches, instruments and measures are particularly suitable to support environmentally sound food security, strengthen the above-mentioned synergies and help address the challenges? Please consider strategies, approaches, tools and measures in the following areas:
   - Land use systems/ approaches
   - Policy environment/ mainstreaming
   - Institutional mechanisms
   - Financing mechanisms

2. What actions are needed at the following levels?
   - National
   - Provincial
   - International

3. Which roles could/should different stakeholder groups (for example, NGOs, government, etc.) play?

**Conclusion**

- Do you have any further suggestions or comments on this topic?
- Where do you think further research is required?
- Can you conclude with a final statement on how to foster synergies between biodiversity conservation and food security?

## Appendix 7: Interview Guide - Biodiversity Conservation

1. South Africa is one of the mega biodiversity reserves of the world. However, many of these biodiversity resources are noted to exist on private and communal lands outside the officially designated protected areas of the nation; and are persistently subjected to threats. Do you think that the South African government recognizes the dangers associated with these threats and is doing enough relative to abating the threats through biodiversity conservation?

2. What are the currently predicted critical impacts of climate change (e.g. changes in temperature, wind speed, humidity and water availability, storm intensity, crop water requirements, pests, water logging, agro-ecosystem shifts, human migration) on agricultural yields, cropping practices, crop disease spread, disease resistance and irrigation development in South Africa?

3. In your opinion, what do you suggest are causing the changes in the climate of South Africa and where would you rank South African agriculture among these factors?

4. How would you describe the relationship between agricultural productivity and biodiversity (and/or other ecosystem services), and how does this vary between agricultural systems?

5. How can the competing demands on land for food production and energy best be balanced to ensure the provision of ecosystem services, while maintaining adequate yields and prices?

6. What approaches (e.g. operational, agronomic, genetic, supplemental irrigation schemes, fertility management) do you suggest should be developed to increase water and land use efficiency in agriculture and what is the cost-effectiveness of these approaches?

7. What benefits do you think that sustainable soil management can deliver for both agricultural production and delivery of other ecosystem services?

8. How can native soil organisms be exploited to maximize food productivity and minimize environmental impacts, particularly on smallholder farms in South Africa?

9. How should the options of intensification, extensification, habitat restoration or the status quo be chosen and how can we best combine measures of economic, environmental and social benefit to make the choice?

10. How can long-term carbon sinks best be created on farms (e.g. by soil management practices, perennial crops, trees, ponds)? And can you expand on the merits of each of these methods?

***Biodiversity conservation and extension***

1. In your opinion, do you think agricultural extension has been helpful in achieving biodiversity conservation objectives in South Africa; and to what extent if they have?

2. Do you think extension is failing to deliver good services relative to biodiversity conservation? If yes, where exactly is it failing?

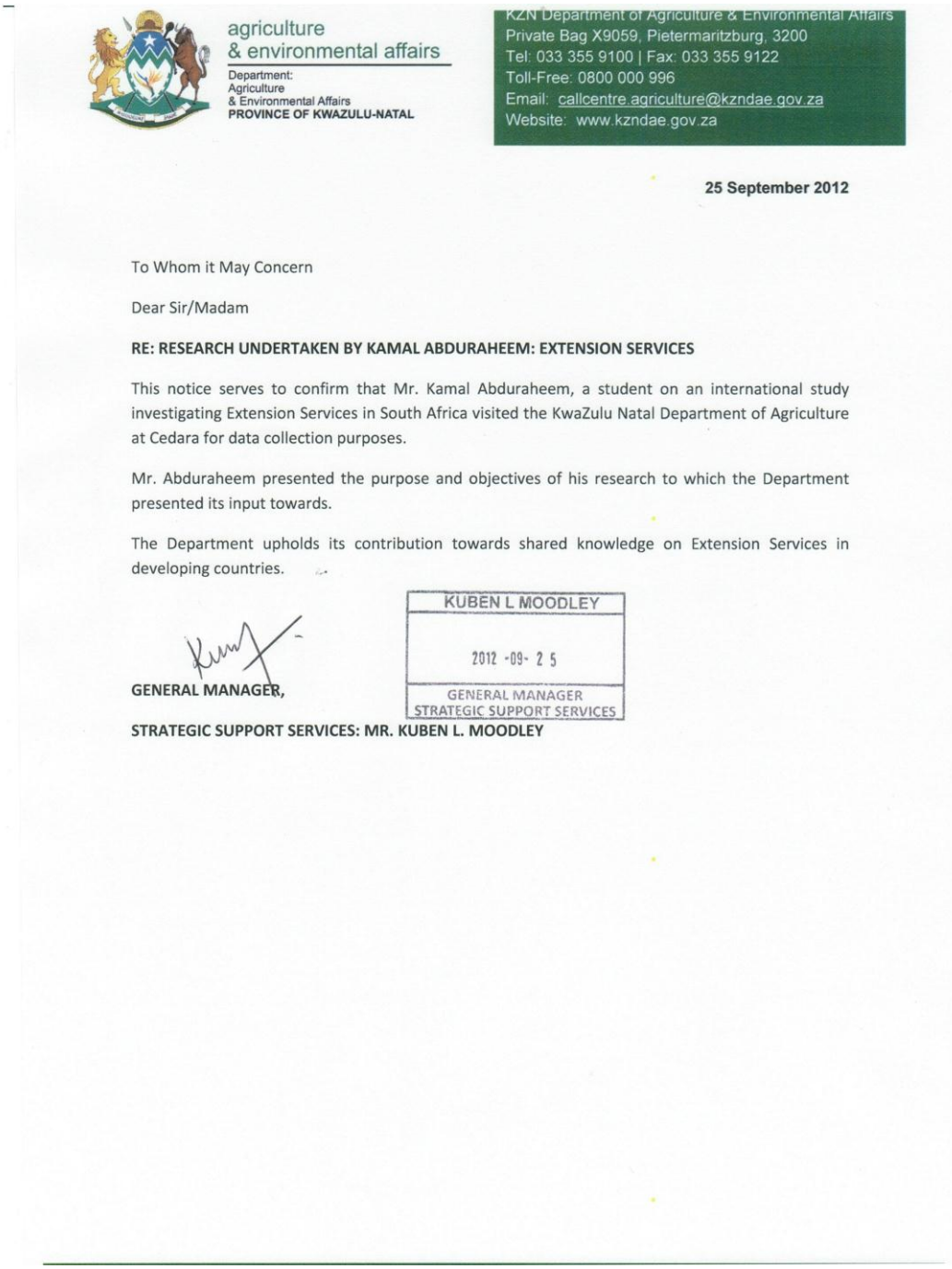
3. In your opinion, how can agricultural extension be more integrated into fulfilling conservation objectives alongside their role of promoting agricultural production which contributes to food security?

4. Do you know of any successful initiative (models) concerning conservation wherein extension is technically involved? And what impacts do these models deliver for them to be seen as successful?

5. What factors make those models positive and successful?

6. Are these models province specific, or do you think they can be replicated in other parts of South Africa?

# Appendix 8: Confirmation of data collection



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**25 September 2012**

To Whom it May Concern

Dear Sir/Madam

**RE: RESEARCH UNDERTAKEN BY KAMAL ABDURAHEEM: EXTENSION SERVICES**

This notice serves to confirm that Mr. Kamal Abduraheem, a student on an international study investigating Extension Services in South Africa visited the KwaZulu Natal Department of Agriculture at Cedara for data collection purposes.

Mr. Abduraheem presented the purpose and objectives of his research to which the Department presented its input towards.

The Department upholds its contribution towards shared knowledge on Extension Services in developing countries.

KUBEN L MOODLEY
2012 -09- 25
GENERAL MANAGER
STRATEGIC SUPPORT SERVICES

**GENERAL MANAGER,**
**STRATEGIC SUPPORT SERVICES: MR. KUBEN L. MOODLEY**