

Environmental Degradation Differences among Rural Farming Communities in the Limpopo Province of South Africa

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ABSTRACT This paper investigated the significant socio-economic characteristics that contributed to differences in attitudes towards environmental degradation among rural farming communities. The population in this study was farmers in rural areas of the Limpopo Province of South Africa. In all, 396 farmers constituted the cohort for the study. Since it was not possible to collect data from all farmers in the province, a simple random sampling method was used in the study. Positive and significant association with environmental degradation was found among farmers with high levels of education, years of farming and household size. It was recommended that since educated farmers in rural farming communities are most likely to understand the detrimental effects of environmental degradation, they should be targeted in research on environmental degradation.

INTRODUCTION

Peri-urban agriculture takes place in the urban periphery where agricultural activities in these areas tend to undergo dramatic changes over a given period of time. When there is an influx of people from both rural and urban areas, population density increases, land prices tend to go up and multiple land use emerges. Such changes affect the agricultural production systems, which tend to become smaller scale with more intensive production, and shift from staple crops towards more perishable crops and animal production (meat, eggs, milk). In addition, in peri-urban agriculture, many types of agriculture may be distinguished depending on size, capital intensity and technology used, crop mix and degree of market-orientation, among others, that is often dominated by irrigated vegetable production (Danso et al. 2002). Experiences in various parts of the world including Cuba, Argentina, Lebanon and Vietnam seem to indicate that farm enterprises located in the fringe of the city are, on average, larger than those that are in the city centres and more strongly market-oriented (De Zeeuw et al. 2000).

Changing farming activities have affected the ways in which natural resources are utilized by farmers. It has also affected the value ascribed to nature, and the importance attached to environmental conservation and rehabilitation. The interrelationships between farming activities and

nature, and the importance of environmental health to social health, have recently become widely acknowledged (Danso et al. 2002). Sustainable development has become a broadly accepted goal, and is seen as an essential element of farm and social development. The term is variously and often rather vaguely defined, but as generally used it implies positive changes in social development that are linked with positive (or at least neutral) changes in the state of the environment. However, the term has also given rise to some controversy, because of substantial disagreement over what the goals of development ought to be (Amar-Klemesu and Maxwell 2000).

De Zeeuw et al. (2000) provide the clearest statement of *Environmental Deprivation Theory*. They argue that the level of public concern for environmental problems is related to agricultural levels of pollution and degradation. Further, it is argued that urban farmers are often more exposed to instances of environmental degradation than are farmers of rural areas. For example, air pollution and water pollution have each been positively correlated with farms located in urban areas. Thus, it has been argued that farmers in urban areas show more concern for environmental issues than do rural farmers (Drechsel et al. 2004). Environmental degradation can also be considered as a result of the dynamic interplay of socio-economic, institutional and technological farming activities. Environ-

mental changes in both urban and rural farming areas may be driven by many factors including economic growth, population growth, urbanisation, intensification of agriculture, rising energy use and transportation (Yi-Zhang and Zhang 2000). However, poverty still remains a problem at the root of several environmental problems. Population is an important source of development, yet it is a major source of environmental degradation when it exceeds the threshold limits of the support systems. Unless the relationship between the multiplying farming and the life support system can be stabilized, new innovations in farming are not likely to yield desired results. Increases in farming population in urban and rural agriculture impacts on the environment primarily through the use of natural resources and production of wastes and is associated with environmental stresses like loss of biodiversity, air and water pollution and increased pressure on arable land (Allen 2001).

The circular link between poverty and environment is an extremely complex phenomenon. Inequality may foster no sustainability because the poor, who rely on natural resources more than the rich, deplete natural resources faster as they have no real prospects of gaining access to other types of resources. Moreover, a degraded farming environment can accelerate the process of impoverishment, again because the poor depend directly on natural assets. Lack of opportunities for gainful employment in rural areas and the accompanying ecological stresses can lead to an ever increasing movement of poor farming communities to urban areas. Growing trends in deterioration of air and water quality, generation of wastes, the proliferation of slums and undesirable land use changes, all contribute to urban poverty (Eddins and Cottrell 2013).

To a large extent, environmental degradation is the result of market failure, that is, the non-existent or poorly functioning markets for environmental goods and services. In this context, environmental degradation is a particular case of consumption or production externalities reflected by divergence between private and social costs (or benefits). Lack of well defined property rights may be one of the reasons for such market failure. On the other hand, market distortions created by price controls and subsidies may aggravate the achievement of environmental objectives. The level and pattern of farm and economic development also affect the nature of

environmental problems. Large quantities of industrial and hazardous wastes brought about by expansion of chemical based industry for farms have compounded the wastes management problem with serious environmental health implications. Transport activities have a wide variety of effects on the environment such as air pollution, noise from road traffic and oil spills from marine shipping. Direct impacts of agricultural development on the environment arise from farming activities which contribute to soil erosion, and loss of nutrients. The spread of green revolution has been accompanied by over exploitation of land and water resources, and use of fertilizers and pesticides have increased many fold through the expansion of farming activities in rural and urban areas. Shifting cultivation in farming has also been an important cause of land degradation. Leaching from extensive use of pesticides and fertilizers is an important source of contamination of water bodies. Intensive agriculture and irrigation contribute to land degradation particularly alkalization and water logging (Armar-Klemesu 2000).

Problem Statement

Rural farming communities in the Limpopo Province of South Africa and everywhere are closely and inextricably linked to the natural environment in which they are embedded (Armar-Klemesu and Maxwell 2000). Human productive and social activities and thus social structures and relations are shaped, to a significant degree, by a number of factors, inclusive of the available natural resource mix, physical geography, weather patterns, the amenability of natural conditions to transformation, and a variety of other environmental characteristics. In the Limpopo Province of South Africa, environmental degradation, including depletion of renewable and non-renewable resources and pollution of air, water and soils, has been a significant source of stress upon the farming communities (Berg and van Den 2002). Environmental degradation has acted on social integration indirectly, through the constraints on productive activities in the area (Tadross et al. 2005). Environmental decline has induced changes in farmer settlement patterns and thus disrupt established social relations among rural and urban farming communities. Environmental degradation can only be understood within the context of the farming activities that the environment supports.

Objectives of the Study

The first objective of this paper was to investigate the significant socio-economic characteristics that contributed to differences in attitudes towards environmental degradation among rural farming communities. The second objective was to determine factors that were associated with the two groups of farmers i.e. those farmers who indicated that their farming activities did not affect environmental degradation in the area compared with those who considered their farming activities to affect environmental degradation. Positive significant association with environmental degradation was hypothesised to be among farmers with high levels of education, years of farming and household size. On the contrary, all other factors remaining the same, farmers who had been involved in environmental degradation programmes and received extension services regularly from their local agricultural extension officers, would indicate that

their farming activities did not contribute to environmental degradation.

METHODOLOGY

Vhembe District Municipality is located in the northern part of the Limpopo province of South Africa (Fig. 1), with estimated provincial populations in 2002 (45.5 million [m] population).

It shares borders with Zimbabwe and Botswana in the north-west and Mozambique in the south-east through the Kruger National Park. The Limpopo River valley forms the border between the district and its international neighbours. It includes the Transvaal, and areas that were previously under Venda and Gazankulu Bantustan's administration. It is comprised of four local municipalities: Musina, Mutale, Thulamela and Makhado. The District Municipal offices, as well as the Thulamela Local Municipality offices, are located in the town of Thohoyandou. It covers a geographical area that is

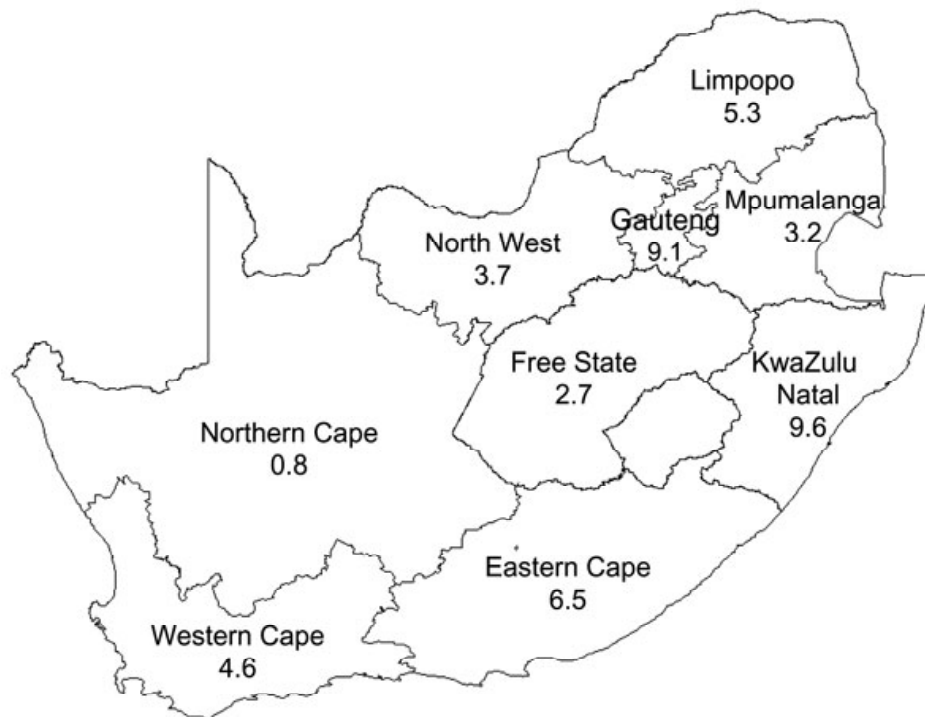


Fig. 1. Map of South Africa showing the position of the Limpopo Province
Source: http://en.wikipedia.org/wiki/File:Map_of_South_Africa (2013)

predominantly rural. It is a legendary cultural hub, and a catalyst for agricultural and tourism development.

The data about farmers' demographic properties and differences in environmental protection among farmers in rural farming communities were collected with the use of a questionnaire which was administered on a face to face basis with the respondent. The population in this study was farmers in the rural areas of the Limpopo Province of South Africa. The unit of observation included farmers in all the districts of the province. In all, 396 farmers constituted the cohort for the study. Since it was not possible to collect data from all farmers in the province, a simple random sampling method was used in the study. Ungrouping simple one step random probability sampling method based on main cluster ratios was used for determining the sample size of the research. In research situations where there is no information available about the selected variables or the variance of a population, a simple random sampling method is used (Manly 1990). The sampling size was determined according to the district population size (Manly 1990). Farmers were randomly selected from each of the six provinces and municipalities. SPSS Version 14.0 was used to analyse the data. In all, respondents were asked whether they perceived their farming activities to affect environmental degradation in their area. Their expected responses were "Yes" or "No". This type of response variable led to the selection of a suitable Limited Dependent variable model for further analysis.

The Model

Binary Logistic regression was considered useful for situations in which the prediction of the presence or absence of a characteristic or outcome based on values of a set of predictor variables was the case (Norusis 2004). The Binary Logistic regression is similar to a linear regression model but is suited to models where the dependent variable is dichotomous as in this study. Binary Logistic regression coefficients were used to estimate odds ratios for each of the independent variables in the model. In the Binary Logistic regression model, the relationship between the dependent variable Z , and the probability of the event of interest is described by the following link function (Norusis 2004):

$$\pi_i = \frac{e^{Z_i}}{1 + e^{Z_i}} = \frac{1}{1 + e^{-Z_i}} \quad \dots\dots\dots \text{Equation 1}$$

$$\text{or} \quad Z_i = \log\left(\frac{\pi_i}{1 - \pi_i}\right) \quad \dots\dots\dots \text{Equation 2}$$

Where: π_i = probability of the i^{th} case; Z_i = value of the independent variable for the i^{th} case. The model assumes that Z is linearly related to the predictors. Thus:

$$Z_i = b_0 + b_1X_{i1} + b_2X_{i2} + \dots + b_pX_{ip} \quad \dots\dots\dots \text{Equation 3}$$

Where X_{ij} = predictor for the j^{th} case; b_j = j^{th} coefficient and p = number of predictors. Since Z is unobservable, the predictors are related to the probability of interest by substituting Z in equation 1.

$$\pi_i = \frac{e^{Z_i}}{1 + e^{Z_i}} = \frac{1}{1 + e^{-(b_0 + b_1X_{i1} + \dots + b_pX_{ip})}} \quad \dots \text{Equation 4}$$

The regression coefficients in the above expression were estimated through an iterative maximum likelihood method using SPSS V.14 (Hosmer and Lemeshow 2000).

RESULTS

The descriptive statistics of the dependent variable is presented in Table 1. Out of a total of 396 farmers interviewed, 171 indicated that their farming activities affected environmental degradation while 225 indicated that their farming activities did not. The low Log Determinants indicate low variability of the two groups. Descriptive statistics of the independent variables in the pooled sample are presented in Table 2. The table indicates the measurement of the variables, minimum and maximum values, computed mean of the variables and their resulting standard deviations. Most of the dependent variables were dummy variables with little deviations from their means as indicated by their standard deviations.

Table 1: Descriptive statistics of the dependent dummy variable

Response	N	Rank	Log determinant
Farming activities contribute to environmental degradation (Y):			
Yes = 1	171	3	-0.296
No = 0	225	3	0.309
Pooled sample	396	3	0.082

Table 3 presents the Analysis of Variation (ANOVA) of the mean variables in the two

Table 2: Descriptive statistics of dependent variables in pooled sample

Variable	Min	Max	Mean	Std. Dev.
Gender (X_1): Male=1; Female=2	1	2	1.47	0.500
Years of Educational (X_2): <5years =0; 6-10years=1; 11-15years=2; 16-20 years=3; 21-25years=4; 26+ years=5	0	5	1.14	1.116
Years of Farming (X_3): <5years =0; 6-10years=1; 11-15years=2; 16-20 years=3; 21 years and above=4	0	4	1.01	1.026
Marital Status (X_4): Married=1; Divorced=2; Widowed=3	0	3	1.72	1.074
Age Group (X_5): 18-25 years=1; 26-35 years=2 36-50 years=3 51+ years=4	1	4	1.72	0.868
Household Size (X_6)	1	11	1.84	1.180
Access to Credit (X_7): Yes=1; No=2	1	2	1.48	0.500
Use of Technology (X_8): Yes=1; No=9	1	9	1.97	1.961
Land Tenure (X_9): Private=1; Communal=9	1	9	2.09	1.771
Participation Programme (X_{10}): Land care=2; Water mgt. =2; Soil conservation=3; others=4	1	4	2.34	1.027
Access to Extension (X_{11}): Very good=1; Good=2; Poor=3; Very poor=4	1	4	2.79	1.032

N=396

Table 3: Test of equality of group means

Variable	Yes = 1 ($N_1=171$)	No = 0 ($N_2=225$)	Wilks' λ	F-statistic	P-value
X_1	1.46 (0.500)	1.47 (0.500)	1.00	0.032	0.857
X_2	1.04 (0.951)	1.22 (2.223)	0.993	2.743	0.098
X_3	0.89 (0.980)	1.09 (1.102)	0.991	3.500	0.062
X_4	1.29 (1.098)	1.32 (1.058)	1.000	0.094	0.759
X_5	1.67 (0.8470)	1.76 (0.883)	0.997	1.234	0.267
X_6	1.71 (1.225)	1.94 (1.138)	0.991	3.675	0.056
X_7	1.44 (0.498)	1.51 (0.501)	0.996	1.728	0.189
X_8	1.89 (1.905)	2.04 (2.004)	0.999	0.543	0.462
X_9	1.99 (1.568)	2.17 (1.910)	0.997	1.010	0.315
X_{10}	2.47 (1.008)	2.23 (1.031)	0.860	5.486	0.020
X_{11}	2.47 (0.959)	2.68 (1.074)	0.985	5.824	0.016

Standard Deviation in brackets ()

groups of farmers. The ANOVA indicates few significant differences in the variability of the means. The results indicate only significant differences of the mean values for years of formal education (X_2), years of farming (X_3), household size (X_6), programmes involved (X_{10}) and access

to extension services (X_{11}). The Binary Logistic regression results are presented in Table 4.

As predicted in the hypotheses, years of formal education (X_2), years of farming (X_3) and household size (X_6) have positive significant association with environmental degradation. On

Table 4: Binary logistic regression results

Variable	β	S.E	Wald	d.f.	P-value	Exp(β)
X ₁	0.210	0.215	0.956	1	0.338	1.233
X ₂	0.213	0.112	3.640	1	0.056	1.238
X ₃	0.234	0.118	3.920	1	0.048	1.264
X ₄	-0.117	0.109	1.142	1	0.285	0.890
X ₅	0.143	0.123	1.345	1	0.246	1.154
X ₆	0.201	0.106	3.561	1	0.059	1.222
X ₇	0.298	0.215	1.920	1	0.166	1.348
X ₈	0.027	0.056	0.225	1	0.635	1.027
X ₉	0.061	0.065	0.875	1	0.349	1.063
X ₁₀	-0.200	0.106	3.559	1	0.059	0.819
X ₁₁	-0.180	0.108	2.786	1	0.095	0.836
Constant	-0.605	0.709	0.728	1	0.393	0.546

Classification Results:

Yes	=	38.0% (65/171)
No	=	74.2% (167/225)
Overall	=	58.6% (232/396)
Cut value	=	0.50

the other hand, programmes involved (X₁₀) and access to extension services (X₁₁) have negative significant association. The Wald Statistic which indicates the ratio of the coefficient to its standard errors squared. The small significant levels of the target variables indicate that the parameters were useful in the model. Exp (β) indicates the ratio of the odds of the event of interest for one unit change in the predictor variable.

DISCUSSION

The results of the study indicated that there were more farmers who perceived that their farming activities did not affect environmental degradation. A plausible explanation could be that these were the farmers who thought that they had attended enough agricultural management programmes and also had received enough guidance from extension services which made them to become competent in their farming operations to avoid contributing to environmental degradation. From a total of 396 farmers interviewed, 171 indicated that their farming activities affected environmental degradation while 225 indicated that they did not. The two groups of farmers did not differ from any appreciable extent in terms of their characteristics. As predicted in the hypotheses, years of formal education, years of farming and household size had positive significant association with environmental degradation. On the other hand, programmes involved farmers and access to extension services have negative significant association.

High levels of education have been observed to influence many educational programmes in environmental degradation (Athman and Monroe 2004). In this study, years of education of farmers interviewed was found to be positively associated with environmental degradation. It could therefore be deduced that farmers with high levels of education were aware of the positive effects of good farm management practices and their impact on the environment. In the same way, an increase in the number of years of farming had positive impact on environmental degradation. Farmers who have cultivated and invested in the land are most likely to be aware of the environmental impact of the weather in areas where their farms are located and are likely to develop adaptation measures (Mandleni and Anim 2011). The results indicated that large household sized farmers were aware of environmental degradation. This outcome may be due to the fact that the larger the family size, the more family members will have diverse knowledge in mitigating environmental degradation.

Participation in community based programmes and access to extension services had negative significant impact on environmental degradation. According to Farrington and Carney (2000), participation in community-based management programs enhances farmers' adaptive capacity by building networks that are important for coping with extreme events. Farmers who have been exposed to such programmes and in addition, receive regular extension services may form the opinion that they are not

aware of any environmental degradation in their area. According to Jacob et al. (2000), building resilience through consolidation of social networks is useful in building resilience and positive attitude towards environmental degradation.

CONCLUSION

This study was to investigate the significant socio-economic characteristics that contributed to differences in perceptions towards environmental degradation among rural farming communities. The study further determined factors that were associated with those farmers who indicated that their farming activities did not affect environmental degradation in the area compared with those who considered their farming activities to be affect environmental degradation.

Empirical analysis was used to indicate socio-economic factors that affected environmental protection differences. The study showed that differences among rural farming communities emanated from differences in educational levels, years of farming and household size. Farmers with high levels of education, years of farming and household size were of the opinion that farming activities contributed to environmental degradation. However, married farmers who participated in environmental degradation programmes and also received extension services indicated that their farming activities did not affect or contribute to environmental degradation.

RECOMMENDATIONS

Educated farmers who have several years of farming should be included in research on environmental degradation since they are likely to be aware of farming practices that go to mitigate environmental degradation. Further studies will be required to ascertain the negative correlation between environmental degradation and other factors like marital status, participation in programmes and access to extension services.

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