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Implications of agricultural land degradation to the profitability and competitiveness of subsistence farmers: A comparative study from rural Ethiopia

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Abstract
Drawing up on data collected in three districts which represent various agro-ecologies, socio-economic and major farming systems in Ethiopia in 1999/2000 cropping season, this paper examines the competitiveness of smallholder farmers in food crop production. Partial budget analysis was carried out to determine both financial and economic profitability for major crops. Policy Analysis Matrix (PAM) indicators, such as NPC, EPC and DRC were employed to scrutinise the incentives generated under a set of existing agricultural policy and competitiveness of smallholder farmer for six major crop-district categories, i.e., sorghum and maize in Alemaya; wheat and barley in Hitosa; and teff (*Eragrostis tef*) and sorghum in Merhabete. Both financial and economic profitability are the highest for wheat grown in Hitosa, but the other categories have also positive returns. The social cost benefit (SCB) ratio and PAM indicators also disclose that domestic production of food crops enjoys comparative advantage even in regions where productivity is highly constrained by land degradation and also face some policy disincentives.

1 Introduction

There is growing evidence that degradation of agricultural soil resource is already seriously limiting production in the developing world and that the problem is getting worse especially for countries like Ethiopia whose agriculture is predominantly characterised by subsistence farming and wide spread poverty. The majority of the smallholder farmers cultivate on impoverished soils on sloping and marginal lands, highly susceptible to soil degrading forces. These farmers constitute the poorest and largest segment of the population whose livelihood depends on the exploitation of the natural resource. Smallholder farmers have responded to resource degradation in various ways. But they often fail to solve the problem ultimately mainly because the issue

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stretches beyond their capability. Therefore, they may just build their local knowledge and learn to cope with and continue to struggle to remain competitive. This paper examines the pattern of agricultural productivity in the three districts which will then employ policy analysis matrix approach to determine competitiveness of smallholder farming.

2 The Study Set-up and Methodology

2.1 The Study Areas and Data Sources

The data examined in this article came from a one-year rural household survey conducted in Alemaya, Hitosa and Merhabete districts during the 1999/2000 cropping season. Alemaya is a district where household food security is attained through combination of on-farm production and exchange. Hitosa district is among the high potential cereals growing regions of Ethiopia. Merhabete represents a marginal area which is recurrently ravaged by drought and land degradation. The study adopted a stratified random sampling procedure with rural household as an ultimate sampling unit for acquiring primary information. The districts were stratified into fairly homogenous agro-ecological zones based on altitude from which peasant associations (PAs) and the peasant households were randomly selected.

A structured survey questionnaire was designed and pre-tested to collect relevant data. The household head was the main source of information. At the beginning of the survey a total of 182 rural households were selected randomly and then each household was interviewed three times during the cropping season. In such a repeated visit, of course, attrition is always a concern. In our case, 149 households provided complete and consistent information until the end of the survey round.

Data on farming activities as well as returns from a total of 540 plots owned and/or operated by sample households were collected in the three-round visit. The visits were executed following a cropping calendar for major crops in each district. Accordingly, the first visit was conducted just after final land preparation, the second after final weeding and/or thinning activities and the third round after harvest.

2.2 The Empirical Model

Descriptive statistics is used to analyse farmers' assessment of land fertility and farm budget is constructed to look at the financial profitability of smallholder farming. The Policy Analysis Matrix (PAM) approach is employed to examine the competitiveness of smallholder farmers in major food crops production.

The PAM is a logical framework appropriate to scrutinise circumstances in which economic policy changes affect agriculture which in turn influence real exchange rates, real interest rates, input and output subsidies and taxes, border measures and marketing institutions. The PAM is able to identify, in an appropriate fashion, which of the country's existing portfolio of commodity systems is likely to be negatively or positively affected by policy reforms in terms of incomes and viability for the individuals in the system (KYDD *et al.*, 1997).

The PAM generates policy indicators for which values can be estimated, notable among others, nominal rate protection coefficient (NPC=A/E), effective rate of protection coefficient (EPC=(A-B)/(E-F)) and domestic resource cost ratio (DRC=G/(E-F)). These indicators help to investigate the impact of policy on competitiveness and farm level profits, the influence of investment policy on economic efficiency and comparative advantage, and the effect of agricultural research policy on changing technologies (MONKE and PEARSON, 1989). The results can be used to identify which farmers and regions, categorised by commodities they grow and the technologies they use, are competitive under current policies affecting crop and input prices and how their net gains change as the policies are altered.

Table 1: The policy analysis matrix

	Revenues	Costs		Profit
		Tradable inputs	Domestic factors	
Private	$A = R^D$	$B = \sum_i p_i^D q_i^D$	$C = \sum_j w_j^D l_j^D$	$D = p^D$
Economic	$E = R^S$	$F = \sum_i p_i^S q_i^S$	$G = \sum_j w_j^S l_j^S$	$H = p^S$
Effect of divergence Or effective policy	I	J	K	L

D: Private profit, $D = A - (B+C)$;
H: Economic profit, $H = E - (F+G)$;
I: Output transfer, $I = A - E$;
J: Input transfer, $J = B - F$;
K: Factor transfer, $K = C - G$;
L: Net transfer, $L = D - H$

Note:
R = revenue from outputs, p_i = unit price of tradable input i, q_i = quantity of i, w_j= unit price of domestic factor j, l_j = quantity of j and p= profit.
The superscript D and S represent that the values are observed under existing market price and economic values, respectively.

Source: MONKE and PEARSON (1989); modified

3 Results and Discussion

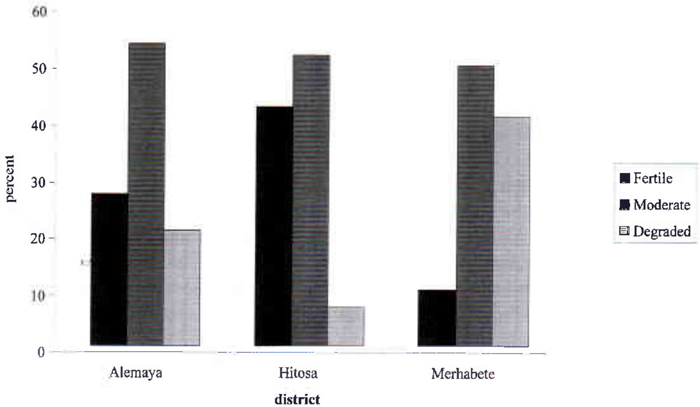
3.1 Soil Fertility Assessment: Farmers' Perception

The main prerequisite for attaining sustainable agricultural development is the formulation of appropriate resource management policies which are supported by the farming communities and to which they are willing and able to respond. The responses, commitments and responsibilities required for the success of such policies still depend on the perception of the problem by smallholder traditional farmers.

Moreover, factors like land tenure, size of farm holdings, availability of agricultural credit, the use of farm inputs, availability and effectiveness of agricultural extension services, farmers' awareness of available technologies, farmers' abilities to afford and apply technologies, and overall agricultural infrastructure contributes significantly to the achievement of sustainable land use (MUSHALA and PETERS, 1998).

In their decision towards investing in soil and water conservation measures, farmers evaluate fertility of each parcel and the anticipated incremental benefits. Farmers in the study areas distinguish between three major classes of soil fertility: *lem* (fertile), *mehakelegna* (moderately fertile) and *tef* (degrared). *Lem* soils usually have heavy texture and represent deep soils. They usually appear on flat topography, hill tops and valley bottoms. *Mehakelegna* soils are found between hillsides and valleys with moderate slope. They are relatively workable as compared to *lem* soils but with comparatively more sand content and shallow depth. *Tef* soils are degraded soils frequently found on hillsides with higher slopes. The shallow depth and larger stone and sand content of the soil limits its water holding capacity and so its agricultural use. It is clear that this classification is not only based on soil nutrient status, but also includes all soil factors affecting plant growth, including topography, depth, workability of soil, texture, water holding capacity, drainage, etc. Farmers then use various observable indicators to access the extent of land degradation on a given parcel of land.

Figure 1: Area covered by each class of soil fertility



Note: total cultivated land surveyed: Alemaya = 70.475 ha; Hitosa = 122.77 ha; and Merhabete = 95.26 ha
Source: Based on author's survey

Each household head was asked to classify each of his parcel of land in accordance with the fertility characterisation mentioned above. The result, as presented in Figure 1, shows that Hitosa district has predominantly fertile soils with *lem* and *mehakelegna* accounting for more that 93% of cultivated land. The case of Merhabete district reflects the contrary. There, *tef* soils constitute more than 40% of the cultivated land, whereas *lem* soils account only for less than 10%. The conditions in Alemaya seems to be moderate, *lem*, *mehakelegna* and *tef* covering 26.6, 53.2 and 20.2% of the cultivated land, respectively..

3.2 Crop Production Performance

Aggregating the values of agricultural produce using market prices and dividing it by total cultivated area by a household gives us a crude estimates of aggregate average land productivity in each category of landholding and district. Table 2 reveals that inter-district aggregate land productivity differences are substantial. The monetary return per unit of cultivated area in Merhabete district is nearly 27% less than the overall average land productivity. When compared with the remaining two districts, a unit area of cultivated land in Merhabete yields only 57% and 68% of the average monetary returns in Alemaya and Hitosa, respectively. These aggregate return differences imply that land degradation in Merhabete has reduced returns to land more than elsewhere.

The monetary returns are larger in Alemaya mainly because most households there rely on cash crop production, particularly *t'chat* and vegetables. The landscapes of both Alemaya and Hitosa are dominantly flatter, and less erodible. Less land degradation implies higher yields, controlling for other factors.

Table 2: Land productivity by district and landholding tercile (ETB / ha *)

	Landholding tercile			
District	Bottom	Medium	Top	District mean
Alemaya	2555.14	2716.57	2923.52	2727.64
Hitosa	2283.07	2281.69	2179.43	2251.48
Merhabete	1711.56	1563.56	1390.14	1552.29
Tercile Mean	2158.95	2133.53	2084.03	2126.11

*: 1 US$ = ETB 8.25
Source: Own computation

Some other important facts revealed in Table 2 worth mentioning are that aggregate monetary returns per unit of cultivated land tends to increase with landholdings in Alemaya (but not statistically significant, P>0.1), remains almost unchanged in Hitosa and tends to decline in Merhabete (the difference is also statistically significant, P<0.1). This implies that in Alemaya district land remains an important constraint in farming to increase returns to the household. More specifically, rural households there do have other resources, i.e., labour and capital, which could have been employed on additional land thereby increasing household income. However, for households in Merhabete district the tendency seems to move in the reverse direction. Two reasons can be forwarded to explain this relationship. First, the predominant staple crop in Merhabete, *teff*, is highly labour intensive. Secondly, land preparation not only involves ploughing but also construction and maintenance of bunds and other soil conservation measures which also demand more labour. Therefore, farming is constrained more by availability of labour and land quality than quantity of land. Households with smaller landholdings, controlling for other factors, can work their fields better and the corresponding returns per unit of cultivated area remains higher.

There is mounting evidence from around the world that show agricultural productivity is inversely related to farm size (FEDER, 1985; LIPTON, 1993), on the grounds that small farms using family labour have significant advantage in reducing labour related transaction costs and achieving higher intensity of work effort per hectare. Household surveys in Rwanda, for instance, revealed that coffee, cassava and banana appear to be most responsive to family labour on small farms, showing yields that are at least 50% above the national average (CLAY *et al.*, 1995).

3.3 Competitiveness of Smallholder Farmers

If we are concerned with comparing mutually exclusive alternative projects, private and economic profitability analysis results are ideal tools for decision making. However, to make comparison across economic sectors, these parameters are less useful because here both are denominated in specific units with a physical *numeraire*. Thus a unit-free ratio is generally preferred for comparison of commodity systems which are dissimilar in the relative proportions in which they use inputs. Social cost-benefit (SCB) ratio and selected PAM indicators are analytical tools which simplify this analysis down to the essentials.

Smallholder farmers in Ethiopia, who produce the bulk of agricultural outputs, are greatly influenced by the market and policy environments and the set of incentives they generate. These incentives generated under a given agricultural policy can be investigated with the use of PAM indicators. The starting point of such an evaluation is to derive the actual costs of production by adjusting the values of domestic costs and tradable products for taxes, subsidies and other elements of price distortions. Once the costs of production are estimated, comparative advantage can be evaluated employing PAM approach (MONKE and PEARSON, 1989; GUMAA *et al.*, 1994; MASTER and WINTER-NELSON, 1995; KYDD *et al.*, 1997; AYELE and HEIDHUES, 1999). The results have strong implications on the competitiveness of farmers operating under different resource endowments and agro-ecological conditions, subjected to policies affecting input and output prices, marketing and transport sectors.

Computed values of SCB ratio and some selected PAM indicators for six district-crop categories are presented in Table 3. The results disclose that even though various inefficiencies can be observed for various commodity categories, the domestic production maintains comparative advantage over import of agricultural produce. For all crop categories SCB ratios are found to be less than one, implying that proportionately less input costs are required to generate a unit of benefit both evaluated at their respective economic values. It is important to note that although financial returns are found to be relatively lower in Merhabete for both *teff* and sorghum mainly attributed to degraded land and remoteness of the region, the social cost benefit ratio still remain less than one. Households there are more subsistence oriented and inadequate developed infrastructure depresses the market price of agricultural produces. However, in terms of economic returns, the region's SCB ratios are among the most attractive with 0.27 and 0.34 for sorghum and *teff*, respectively. One implication of such result is that in order to promote economic efficiency focusing only on regions with the highest production potential is a flimsy. Pursuing appropriate policy instruments on degraded lands and remote areas could contribute to the overall economic efficiency of the country.

Table 3: Social Cost-Benefit ratio and selected Policy Analysis Matrix indicators

District	Crop	SCB	NPC	EPC	DRC
Alemaya	Sorghum	0.43	1.23	1.31	0.32
	Maize	0.45	1.19	1.28	0.31
Hitosa	Wheat	0.36	0.86	0.88	0.20
	Barley	0.59	0.74	0.70	0.38
Merhabete	Teff	0.34	0.89	0.89	0.26
	Sorghum	0.27	0.92	0.92	0.22

Source: Author's computation

Further scrutiny into the results shows that the current sets of policies such as exchange rate reforms, agricultural output market liberalisation and removal of imported input subsidies have eroded the level of protection for farmers in Hitosa and Merhabete. All crop categories in Hitosa and Merhabete are subjected to implicit taxes. Households in Hitosa who grow barley are the most taxed (30%) and those households in Merhabete who grow sorghum are the least taxed (8%). On the other hand, rural households in Alemaya enjoy some degree of protection. Sorghum farmers enjoy the highest level of effective protection (31%).

The returns to alternative policies and technology strategies in different locations will depend upon the comparative advantage a given region holds. Comparative advantage is the ability of a region to produce a unit of commodity at a lower opportunity cost of domestic factors of production employed than obtaining it by imports. The DRC coefficient is used in this study to evaluate the comparative advantage of the crop categories under consideration. The DRC coefficient measures the cost of domestic factors of production used to earn or save a net unit of foreign exchange. A given crop production system to be the efficient user of domestic resources, the foreign exchange cost of its local production must be less than its import cost.

All crop categories we considered had DRC coefficients less than one, indicating that these crops are competitive and the country has comparative advantage in producing them. A major reason may be that relatively fewer imported inputs are employed in producing them. Following the procedure towards determining DRC isolates the costs of domestic factors. Therefore, it undertakes economic profitability of activities that make intensive use of domestic resources instead of tradables. Consequently, it may not be consistent with activities which maximise economic profitability from both, domestic factors and tradable intermediate inputs.

It is apparent from the DRC coefficients that domestic factor efficiency ranges from 0.20 to 0.38 for wheat and barley in Hitosa district, respectively. The results further confirm that local production enjoys comparative advantage even in regions which are suffering from resource degradation like Merhabete district. Therefore, promoting local production through the provision of appropriate policies and infrastructure can have magnificent contribution to not only meet the overriding objective of food self-sufficiency, but also instigate economic growth.

3.4 Sensitivity Analysis

Being static, most analytical base cases do not incorporate the effect of changes in input and output parameters over time as they generally present only most plausible outcomes. Therefore, regardless of the basis of the primary analysis, such point estimates alone do not provide policy makers with information about the full range of potential outcomes. Additional information is needed if the decision-maker is to have a more comprehensive view of the potential impacts of policy alternatives. One of the procedures to achieve this objective is to conduct sensitivity analysis and observe how output parameters change in response to changes in assumptions regarding input parameters.

Table 4: Sensitivity analysis of Social Cost-Benefit ratio and PAM indicators

Input		Alemaya		Hitosa		Merhabete	
Parameter	Indicators	Sorghum	Maize	Wheat	Barley	Teff	Sorghum
20% increase in crop yield	SCB	0.36	0.37	0.28	0.49	0.29	0.23
	EPC	1.29	1.26	0.82	0.71	0.90	0.92
	DRC	0.26	0.25	0.15	0.29	0.21	0.18
10% increase in import parity price	SCB	0.39	0.41	0.31	0.54	0.31	0.25
	EPC	1.17	1.14	0.73	0.61	0.81	0.83
	DRC	0.29	0.28	0.16	0.33	0.23	0.19
20% decrease in cost of production	SCB	0.34	0.36	0.27	0.47	0.27	0.22
	EPC	1.29	1.26	0.82	0.71	0.89	0.92
	DRC	0.25	0.24	0.17	0.27	0.20	0.17
20% decrease in domestic price of output	SCB	0.43	0.45	0.34	0.59	0.34	0.27
	EPC	1.16	1.13	0.72	0.59	0.79	0.82
	DRC	0.32	0.32	0.18	0.38	0.26	0.22

Source: Author's computation

Even though a range of input parameters are key elements in profitability and competitiveness analysis, a full sensitivity analysis that includes all variations at the same time is not feasible in most cases. Hence, it is important to limit the sensitivity analysis to those input parameters that are considered to be of particular importance. The approach employed here is, therefore, a partial sensitivity analysis, in which change in the outcome parameter is estimated while varying a single input parameter, leaving the other input parameters at their base values. Results are presented in Table 4.

The overall exercise of sensitivity analysis points to the fact that policies that help to increase yield per unit cultivated area and/or reduce costs such as improved infrastructure, market information and distribution facilities will enhance economic efficiency and international competitiveness. However, policy makers should think, at the same time, about the effect of declining prices as a result of increasing yield and thereby the supply of agricultural produce. The results here indicate that the benefits from increasing yield more than outweigh the negative consequences of increased supply if the excess supply can be made available for the international market to benefit from its comparative advantage. Thus, promoting yield enhancing and/or reducing cost of production policy instruments should be coupled to the capacity of the nation to access external markets for its agricultural produce and improve infrastructure, particularly storage capacity, transportation and information systems.

4 Conclusion

Even though limited availability of resources may hamper their decision to invest in SWC measures, rural households can give adequate assessment of the fertility status of fields they operate. However, very few conservation specialists deliberately tried to identify constraints these farmers are encountered with in formulating conservation projects, which in most cases ended up in failure.

Food crops can be produced at lower opportunity costs of domestic factors employed than obtained by imports even in marginal areas like Merhabete. But government policies and market imperfections which are a common phenomena whenever a system is characterised by inadequate development of institutions to provide competitive services and full information, constitute the important sources of disincentive to the agricultural sector. Moreover, the findings confirm that the withdrawal of the state from marketing since 1992 and gradual removal of other policy variables have not led to a more efficient marketing system. It is generally accepted that the private sector can have advantage over the state marketing organisation when it comes to minimising transaction costs but this advantage will not be realised in the absence of institutions which minimise these costs (KYDD *et al.*, 1997). Although the withdrawal of the state from direct market intervention in Ethiopia allowed private sectors to move in to fill part of the gap, inadequate development of institutions forced farmers to pay higher prices for inputs and credits, and receive lower farm gate prices for their produce. In this course, traders and money lenders seem to make more than average profit.

5 Zusammenfassung

Diese Forschung wurde mit dem Ziel ausgeführt, die Bedeutung landwirtschaftlicher Bodendegradierung für Rentabilität und dem Wettbewerbsfähigkeit von Kleinbauern in Äthiopien zu untersuchen. Um diese Ziele zu erreichen, werden Beobachtungen und Ergebnisse einer Umfrage in ländlichen Haushalten angeführt, die in drei Gebieten mit unterschiedlichen agroökologischen und sozioökonomischen Merkmalen durchgeführt wurden. Die Daten wurden mit Hilfe von strukturierten Fragebögen während der Erntezeit 1999/2000 sowohl für den Haushalt als auch die Grundstücksebene gesammelt.

Die Umfragedaten wurden zur Einschätzung von Rentabilität und Wettbewerbsfähigkeit von Kleinbauern genutzt, die mit verschiedenen sozioökonomischen und agroökologischen Zwängen konfrontiert sind. Eine Teilkostenrechnung wurde vorgenommen, um die Rentabilität der Produktion einzelner Getreidearten zu untersuchen, und Policy Analysis Matrix (PAM) Verfahren wurden verwendet, um die Wettbewerbsfähigkeit und der Einfluß politischer Steuerung zu untersuchen. Sechs Produktionsstandorte wurden für eine ausführliche Untersuchung unterschieden. Die Ergebnisse, sowohl der finanziellen als auch der ökonomischen Analyse zeigen, daß der Weizen, der in Hitosa angebaut wird, den höchsten Nettogewinn erbringt, während die anderen Getreidearten ebenfalls positive Nettogewinne erzielen. Der Ansatz zur Analyse der Wettbewerbsfähigkeit von Kleinbauern zeigt, daß diese Ackerfrüchte wettbewerbsfähig sind, auch in Gebieten mit degradierten Ressourcen, weil die Kosten für inländische Produktionsfaktoren relativ gering sind (DRC<1). Man kann auch feststellen, daß die Liberalisierung der Wirtschaft und die Beendigung der Input-Subvention unterschiedliche Auswirkungen auf die Produktion von Getreide hat. Während die in Alemaya angebauten Ackerfrüchte eine indirekte Nettosubvention (EPC>1) erhielten, waren die in Hitosa und Merhabete angebauten von einer indirekten Nettosteuer betroffen (EPC<1).

Die oben erwähnten Ergebnisse bestätigen, daß der Rückzug des Staates aus der Vermarktung und die Abschaffung anderer Politikvariablen nicht notwendigerweise direkt zu einem effizienteren Vermarktungssystem führen. Der Rückzug des Staates aus der direkten Marktintervention in Äthiopien seit Anfang der 90er Jahre, erlaubte dem privaten Sektor, einen Teil dieser Lücke zu füllen. Aber die unzulängliche Entwicklung von Institutionen zwingt die Bauern, höhere Preise für Betriebsmittel und Kredite zu zahlen und niedrigere Preise für ihre Produkte zu akzeptieren. Der größte Teil der Gewinne scheint von Händlern und Geldverleihern abgeschöpft zu werden.

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6 References

AYELE, GEZAHEGN and F. HEIDHUES, 1999: "Economic Returns of Vertisol Innovation: An Empirical Analysis of Smallholder Mixed Farming in the Highlands of Ethiopia." *Journal of Agriculture in Tropics and Subtropics* 100: 69-81

BLUME H. P., EGER H., FLEISHHAUER E., HEBEL A., REIJ C. and K. G. STEINER (eds.), 1998: Towards Sustainable Land Use: Further Cooperation Between People and Institutions Volume II. Advances in Geoecology 31, Catena Verlag GmbH, Reiskirchen.

CLAY D.C., BYIRINGIRO F., KANGASNIEMI J., REARDON T., SIBOMANA B., UWAMARIYA L. and D. TARDIF-DOUGLIN, 1995: Promoting Food Security in Rwanda Through Sustainable Agricultural Productivity: Meeting the challenges of Population Pressure, Land Degradation and Poverty. MSU International Development Paper No. 17. East Lansing.

FEDER G., 1985: "The Relationship between Farm Size and Farm Productivity: The Role of Family Labour, Supervision and Credit Constraints." *Journal of Development Economics* 18(2-3): 297–313

GUMAA Y., FAKI H. H., MOHAMED A. I. and M. A. ISMAEL, 1994: "Profitability Analysis of Food Grains in the Sudan's Irrigated Agricultural Sector." *Agricultural Economics* 11: 325–333

KYDD J., PEARCE R. and M. STOCKBRIDGE, 1997: "The Economic Analysis of Commodity systems: Extending the Policy Analysis Matrix to Account for Environmental Effect and Transaction Cost." *Agricultural Systems* 55: 323-345

LIPTON M., 1993: "Land Reform as Commenced Business: The Evidence against Stopping." *World Development* 21(4): 641-657

MASTER W. A. and A. WINTER-NELSON, 1995: "Measuring the Comparative Advantage of Agricultural Activities: Domestic Resource Costs and the Social Cost-Benefit Ratio." *American Journal of Agricultural Economics* 77: 243-250

MONKE E. A. and S. R. PEARSON, 1989: The Policy Analysis Matrix for Agricultural Development. Cornell University Press, Ithaca.

MUSHALA H.M. and G. PETERS, 1998: "Socioeconomic Aspects of Soil Conservation in Developng Countries: The Swaziland Case." In BLUME, H. P., H. EGER, E. FLEISHHAUER, A. HEBEL, C. REIJ and K. G. STEINER (eds.) Towards Sustainable Land Use: Further Cooperation Between People and Institutions Volume II. Advances in Geoecology 31, Catena Verlag GmbH, Reiskirchen.