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## 2.5 The Opportunity Costs of Protected Areas in Uganda

by Peter Howard

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**Overview.** *This paper's aim is to assess in financial terms the opportunity cost of excluding human settlement, cultivation and pastoral activities from Uganda's National Parks, Game Reserves and Forest Reserves. These protected areas represent 16.7% of the country's land area. Increasing demographic, economic and associated political pressures are pushing for the opening of these lands for agro-pastoral use. The analysis of the opportunity cost is composed of six stages: first, the assessment of the land under cultivation; second, the assessment of the land area under protection; third, assessment of the land area available for livestock; fourth, the estimation of land values under cultivation; fifth, the estimation of land values under livestock; and finally, calculation of the potential value of protected area land under agro-pastoral development. The result of the analysis is that the total opportunity cost of maintaining Uganda's protected areas amounts to an estimated US\$110 million/yr. This number exceeds the gross revenues of the protected area system by 100 times. Thus, the conversion to agro-pastoral use would be financially preferable to maintaining the status quo. The lesson in terms of biodiversity conservation is that incentive measures are necessary to make such preservation worthwhile in economic terms.*

### 2.5.1 Introduction

A recent valuation of the costs and benefits associated with Uganda's protected areas has been carried out (Howard, 1995) which aims to highlight the opportunity cost of excluding human settlement, cultivation and pastoral activities from the country's national parks, game reserves and forest reserves. As one element of the broader cost-benefit analysis, this proved to be by far the most important economic factor, and it is clearly going to be an important influence on the long-term viability of the protected areas, and the biodiversity they support.

Uganda straddles the equator in east-central Africa, and is the continent's fourth most densely populated country. It is a relatively small country (236,000km<sup>2</sup>, about the same as Britain), richly endowed with renewable natural resources, including fertile agricultural soils, lakes, wetlands, forests and pastoral lands. More than 90% of the country's 17 million people live in the rural areas, where they depend on small-holder agriculture and livestock keeping. The population is increasing at 2.5% annually, and is expected to double in the next 25 years.

Altogether, 32,400km<sup>2</sup> of land is designated as national parks, game reserves and forest reserves, and thereby protected by the government against human settlement, cultivation and livestock grazing. This is

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equivalent to approximately 13.7% of the total area of the country (including lakes), or 16.7% of its land area. Most of these reserves were established early this century under British Protectorate administration when there were only three million Ugandans, and land-use pressures were very much lower than they are today. During the 1970s and 1980s, when Uganda endured a long period of civil unrest and economic decline, many of the country's protected areas suffered from poaching, timber cutting and encroachment, and it has only been possible to reverse these losses in recent years with strong political leadership and outside donor support. Nevertheless, it remains an open question whether, and for how long, the country's protected areas can survive in the face of increasing demographic, economic and associated political pressures.

The term "opportunity cost" is used here to describe the potential benefits foregone as a result of protecting an area rather than using it in some other way. There are many ways of looking at such costs, which depend on the degree of protection any particular site is afforded: thus, the opportunity costs implied in preserving an intact area of rainforest are much higher than those associated with multiple-use management of a similar area, where community-use of resources and sustainable timber harvesting are permitted.

The potential value of sustained timber production and game utilisation from Uganda's protected areas has been examined elsewhere, together with the value of these areas to local communities as a source of "wildlife" products (Howard, 1995). Where such uses are outlawed (as is commonly the case in National Parks, or under the present moratorium on pitsawing and hunting), the potential benefits foregone become "opportunity costs". It is not the intention to discuss such issues further in this paper, but rather to examine the much larger costs associated with the exclusion of human settlement, cultivation and pastoralism from protected areas.

This is an extremely important issue, and one that is likely to gain increasing prominence as human populations continue to grow, creating ever more demands on the land. As is evident from the massive encroachment of protected areas experienced during the 1970s and early 1980s, there is already a substantial demand for additional land, suitable for conversion. The pressure to "release" land from the protected area estate will undoubtedly grow, and protected areas will increasingly need to "compete" with these alternatives. It is therefore essential to understand something of the economics of alternative land uses, if appropriate management strategies for protected areas are to be developed.

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## 2.5.2 Methods

The approach used here expresses the opportunity costs of Uganda's protected areas in terms of expected net returns from conversion to land-use patterns characteristic of similar adjacent areas. Whilst accepting that this represents a gross over-simplification of complex land-use patterns, it is assumed that protected area land has the potential to support cultivation and livestock in the same proportions, and at similar stocking densities to those observed nearby, as determined by Uganda's National Census of Agriculture and Livestock.

The analysis is carried out on a district basis, rather than a land classification one, because the necessary data are available: nevertheless it would clearly be more appropriate to examine the potential of land within the protected estate through a more detailed analysis of its inherent capability to support various alternative crops, and/or livestock densities.

The analysis was carried out in six stages as follows:

**STEP 1.** Assessment of the land area under cultivation in each of Uganda's districts. Based on published sources and unpublished government reports, data were compiled for each district on human population densities outside protected areas; the area of land cultivated *per capita*; and the derived total area under cultivation.

**STEP 2.** Assessment of the land area under protection as parks and reserves in each district. Again, published and unpublished sources were used to compile a complete list of protected areas by district.

**STEP 3.** Assessment of the land area available for livestock in each district. Land which was neither under cultivation nor reserved, was assumed to be used for livestock or lying vacant or under-utilised. Based on government livestock census figures for each district, an average stocking density for this land was derived.

**STEP 4.** Estimation of land values under cultivation. World Bank statistics of the total area of land under each of Uganda's 18 major crops, and gross margins per hectare, were used to derive a figure for the average gross margin for land under cultivation in Uganda.

**STEP 5.** Estimation of land values under livestock. Similarly, available data on the economics of livestock production systems were used to calculate gross margins per hectare within each district, under observed stocking densities (derived in STEP 3, above).

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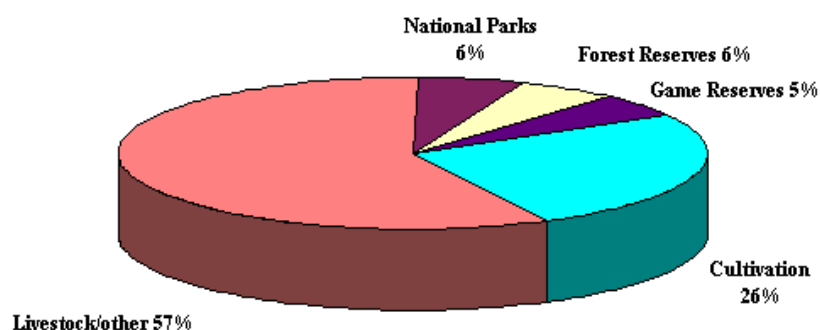
**STEP 6** Calculation of the potential value of protected area land under agro-pastoral development. Based on the derived values describing the ratio of cultivated: pastoral land, and average gross margins for agricultural and livestock systems, the potential value of the land presently under protection was calculated.

### 2.5.3 Results

#### Land Use Patterns

Population and land use statistics for 32 (1991) districts are provided in Table 1, based on the 1991 Population Census, the National Census of Agriculture and Livestock, and unpublished government statistics on the areas of reserved lands. Overall, about 26% of Uganda's land is under cultivation, 17% is managed as parks and reserves, and 57% is used for livestock or other purposes (Figure 1). There are only eight districts in which more than two thirds of the available (i.e. non-reserved) land is already under cultivation, and ten where less than a quarter is cultivated.

**Figure 1 Land Use in Uganda in 1993/94**



#### The profitability of agricultural systems

A summary of World Bank statistics on gross margins and returns to family labour for each of Uganda's principal 18 crops is provided as Table 2. An estimated 46,000km<sup>2</sup> of Uganda's land is presently under cultivation, the most important crops being matoke (cooking bananas; 30% of the total cultivated area); beans and peas (14%) and potatoes, maize, millets and cassava (each 8-10% of the total). The gross margins earned through traditional handhoe cultivation methods range from an equivalent of US\$42-

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44 for tea and robusta coffee, to US\$343-9 for paddy rice and tobacco. Overall, the average gross margin for land under cultivation in Uganda is estimated at US\$120/ha/yr (Table 2).

### **The profitability of livestock systems**

Table 3 summarises livestock census statistics for each district, and derived stocking densities and gross margins for livestock production systems. Stocking densities on the land that is available for livestock, range from between 0.1 Tropical Livestock Units (TLU) per hectare in Luwero, Soroti, Gulu, Kitgum, Lira and Moyo districts; to more than 1.0 TLU per hectare in Tororo/Pallisa and Kabale/Kisoro districts. The Agricultural Secretariat of the Bank of Uganda considers an average “safe carrying capacity” for Uganda's rangelands to be 0.5 TLU per hectare, suggesting that the “national herd” of 3.45 million TLU would require 69,034km<sup>2</sup>, considerably less than the 114,338km<sup>2</sup> that is theoretically available (Table 3). Estimated gross margins for livestock production systems range between \$0.2 /ha/yr in Kitgum district to \$71.3 in Tororo/Pallisa districts.

Based on average gross margins of US\$120/ha/yr for cultivated lands, and gross margins for livestock production systems in each district as shown in Table 3, the total opportunity cost of maintaining Uganda's protected areas amounts to an estimated US\$110 million/yr (Table 3). This cost is very unevenly distributed between districts, with 45% of the total attributable to Moroto, Bushenyi, Kasese, and Masindi districts, areas with a high proportion of land set aside as parks and reserves.

### **2.5.4 Discussion**

The total opportunity cost of Uganda's protected areas, calculated in this way, exceeds gross revenues under present management (approximately \$1 million in 1993/94) by 100 times, and the much larger benefits associated with community-use of products from protected areas (valued at approximately \$33 million annually) by about three times (Howard, 1995). Even when the opportunity cost is compared with potential revenues under improved management combined with the value of products used by nearby communities, the figures indicate that conversion to agro-pastoral use would be financially preferable to maintaining the status quo.

This may be the case, but some caveats are clearly necessary. Obviously, the calculations undertaken here are extremely crude, and depend on a number of assumptions which are only partially valid.

First, the method assumes that protected area land in each district has the same development potential as other land in the district. In many cases, this

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is probably valid, but there are also many instances where protected areas occupy marginal lands with very much lower-than-average potential for agro-pastoral development. High potential areas were settled before any protected areas were created in the early part of this century, so protected areas inevitably occupy land that is to some extent marginal. In the most extreme cases, several National Parks and Forest Reserves occupy steep, high-altitude mountain slopes which have virtually no potential for agro-pastoral development.

Second, the method assumes that land is a limiting factor in the Ugandan economy and that, if the protected area land were made available for settlement it could be developed immediately to levels of productivity observed elsewhere in each district. Although this may be so in a few parts of the country (e.g. the south-western districts of Kabale, Kisoro, Rukungiri and Bundibugyo; and densely populated parts of the south-east such as Mbale and Tororo districts) it is almost certainly not universally the case. Most of Uganda's land is potentially cultivable, but only 26% of it is actually cultivated, mainly because of the limits imposed by the use of traditional (i.e. handhoe) small-holder agricultural systems, typical in Uganda. Likewise, the land "available" for livestock is only partially used at present, partly because of the after-effects of war, inter-tribal and civil strife, cattle-raiding and livestock diseases. Thus, although much of the land designated as protected area undoubtedly has agro-pastoral development potential, this is unlikely to be realised for some time because of constraints other than land shortages.

Third, the method assumes that conversion of protected area land would be achieved instantaneously and have no associated costs or benefits. This is plainly not the case, since hand-tool clearing of land for cultivation is an extremely labour-intensive activity; and many areas would provide a one-off opportunity for commercial exploitation of the existing resources, whether they be game meat, timber or other products.

The analysis could undoubtedly be improved through a closer examination of land-use potential and characteristics within each protected area (using, for example, Langdale-Brown *et al.*'s (1964) vegetation classification), coupled with the use of more locally-applicable data describing the economics of cropping systems in different parts of the country. This would overcome some of the shortcomings noted above, and could be expected to lower the estimate of total opportunity costs derived in the present analysis. Despite its shortcomings, however, this analysis has important policy implications, since it highlights the potential long-term value of protected areas under alternative use, and the need to enhance their economic value in order to ameliorate inevitable future conflicts over land-use.

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## References

Howard, P.C. 1995. The economics of protected areas in Uganda: costs benefits and policy issues. Unpublished MSc thesis, University Of Edinburgh.

Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. 1964. *The vegetation of Uganda, and its bearing on land-use*. Uganda Government Printer, Entebbe, Uganda.

**Table 1 Population and land use by district**

REGION/district	Total land area 1/ (km <sup>2</sup> )	Forest reserve area 2/ (km <sup>2</sup> )	National Park area 3/ (km <sup>2</sup> )	Game reserve area 3/ (km <sup>2</sup> )	Area available for use (km <sup>2</sup> )	Rural pop'n 000s 1/ 1991	Pop'n density on available	H'sehold size 1/(person)	H'sehold density (No./km <sup>2</sup> )	Cultivated land per person	Estimated area cultivated	Proportion available land cultivated	Area available for stock (km <sup>2</sup> )
<b>CENTRAL:</b>													
Mpigi	4,514	378	0	0	4,136	796	192	4.3	45	0.38	3,025	73	1,111
Mukono	4,594	594	0	0	4,000	717	179	4.3	42	0.38	2,725	68	1,275
Luwero	8,539	537	0	0	8,002	408	51	4.4	12	0.38	1,550	19	6,452
Masaka/Kalanga	5,963	221	0	0	5,742	776	135	4.4	31	0.34	2,540	44	3,202
Rakai	3,889	323	0	0	3,566	366	103	4.6	22	0.34	1,244	35	2,322
Mubende/Kiboga	9,821	856	0	0	8,965	602	67	4.4	15	0.32	1,482	17	7,483
<b>EASTERN:</b>													
Iganga	4,823	330	0	0	4,493	899	200	5	40	0.33	2,949	66	1,544
Jinja	677	58	0	0	619	208	336	4.6	73	0.33	682	110	0
Kamuli	3,332	11	0	0	3,321	473	142	4.9	29	0.33	1,551	47	1,770
Kapchorwa	1,738	0	672	0	1,066	112	105	5	21	0.34	432	41	634
Kumi	2,457	3	0	0	2,454	225	92	5.2	18	0.79	1,771	72	683
Mbale	2,504	7	520	0	1,977	645	326	4.5	72	0.38	2,477	125	0
Soroti	8,526	131	0	0	8,395	384	46	4.8	10	0.79	3,022	36	5,373
Tororo/Pallisa	3,900	52	0	0	3,848	842	219	4.8	46	0.39	3,259	85	589
<b>NORTHER</b>													

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Apac	5,887	122	0	0	5,765	454	79	4.7	17	0.54	2,461	43	3,304
Arua	7,595	582	0	156	6,857	598	87	6	14	0.26	1,525	22	5,332
Gulu	11,560	301	2,000	0	9,259	296	32	4.9	6	0.53	1,578	17	7,681
Kitgum	16,136	780	0	0	15,356	340	22	4.9	4	0.53	1,812	12	13,544
Kotido	13,208	1,458*	1,442	0	10,308	181	17	5.6	3	N/A			<10,308
Lira	6,151	89	0	0	6,062	471	78	4.5	17	0.54	2,553	42	3,509
Moroto	14,113	1,085	0	6,907	6,121	158	26	4.9	5	N/A			<6,121
Moyo	4,668	344	0	0	4,324	168	39	4.9	8	0.26	428	10	3,896
Nebbi	2,781	102	0	0	2,679	292	109	5.3	21	0.26	745	28	1,934
WESTERN :													
Bundibugyo	2,097	37	464	548	1,048	116	111	5.6	20	0.2	232	22	816
Bushenyi	4,906	492	978	155	3,281	735	224	5.6	40	0.25	1,838	56	1,443
Hoima/Kibale	7,771	828	0	0	6,943	395	57	4.7	12	0.32	1,248	18	5,695
Kabale/Kisoro	2,315	56	149	0	2,110	598	283	5	57	0.29	1,710	81	535
Kabarole	8,109	335	1,119	206	6,449	741	115	4.8	24	0.25	1,853	29	4,596
Kasese	2,724	75	1,408	0	1,241	343	276	5.3	52	0.2	686	55	555
Masindi	8,458	800*	1,860	1,460	4,338	275	63	5	13	0.32	869	20	3,469
Mbarara/Ntungamo	10,587	187	536	0	9,864	930	94	5.4	17	0.17	1,618	16	8,246
Rukungiri	2,584	34	196	328	2,026	388	191	5.4	35	0.29	1,110	55	916
TOTALS	197,096	11,208	11,344	9,760	164,784	237					50,976		114,338

- 1/ National population and housing census, 1991, provisional figures  
 2/ Forest Department records, excluding areas also gazetted as National Parks or Game Reserves  
 3/ UNEP Strategic Resources Planning report Vol II, Wildlife and Protected Areas  
 4/ Uganda national agricultural census report

**Table 2 Areas planted and gross margins for Uganda's principal crops, using traditional (handhoe) farming methods (as at May, 1991)**

CROP	Area planted 1990 (000s)	Proportion of cultivated land (%)	Yield kg/ha	Producer price Ushs/kg	Value of output Ushs/ha <sup>a</sup>	Variable cost Ushs/ha <sup>a</sup>	Gross margin Ushs/ha <sup>a</sup>	Gross margin US\$/ha	Contribution to average gross margin <sup>2/</sup> US\$/ha
Coffee (R)	210	4.5	1,100	120	132,000	92,916	39,084	44	2
Coffee (A)	30	0.6	750	350	262,500	117,734	144,766	163	1
Tea	21	0.4	5,000	45	225,000	187,980	37,020	42	0.2
Cocoa	10	0.2	1,200	180	216,000	76,640	139,360	157	0.3
Matoke	1,379	29.7	9,000	45	405,000	220,000	185,000	208	61.8
Sugar	31	0.7							N/A
Cotton	69	1.5	550	220	121,000	55,287	65,713	74	1.1
Maize	389	8.4	2,000	60	120,000	79,313	40,687	46	3.9
Beans/Peas	668	14.4	750	150	112,500	54,604	57,896	65	9.4
Groundnuts	191	4.1	800	300	240,000	105,872	134,128	151	6.2
Soyabeans	37	0.8	1,000	160	160,000	53,422	106,578	120	1
Simsim	124	2.7	400	300	120,000	43,959	76,041	86	2.3
Cassava	371	8	7,500	20	150,000	95,183	54,817	62	5

CROP	Area planted 1990 (000s)	Proportion of cultivated land (%)	Yield kg/ha	Producer price Ushs/kg	Value of output Ushs/ha	Variable cost Ushs/ha	Gross margin Ushs/ha	Gross margin US\$/ha	Contribution to average gross margin <sup>2/</sup> US\$/ha
Potatoes	448	9.6	4,000	30	120,000	54,628	65,372	74	7.1
Millets	376	8.1	1,500	100	150,000	51,218	98,782	111	9
Sorghum	240	5.2	1,600	100	160,000	51,787	108,213	122	6.3
Paddy rice	44	1	1,750	210	367,500	62,762	304,738	343	3.4
Tobacco	4	0.1	950	700	665,000	358,910	306,090	345	0.3
<b>TOTALS</b>	<b>4,642</b>	<b>100</b>							<b>120.3</b>

1/ World Bank Country Study "Uganda: Agriculture" (1993), Tables 1,4 (Note: Derived total does not take into account double-cropping, and is likely to be an over-estimate)

2/ Calculated as proportion of total cultivated area x gross margin for each crop

**Table 3 Gross margins for livestock production systems in each district, and overall opportunity costs of protected area land under agro-pastoral development**

REGION/ DISTRICT	Total land area 1/ (km <sup>2</sup> )	Estimated area cultivated by 1991 pop'n (km <sup>2</sup> )	Area available for stock (km <sup>2</sup> ) 1/	Recorded livestock numbers 2/ (000s TLU; 1994)	Derived stocking density (TLU/ha)	Gross margin Milk production 3/ (US\$/ha)	Gross margin Meat production 4/ (US\$/ha)	Gross margin Overall livestock (US\$/ha)	PA land Overall opportunity cost 5/ (millions US\$)
<b>CENTRAL:</b>									
Mpigi	4,514	3,025	1,111	115.5	0.94	10.6	13.1	23.7	3.56
Mukono	4,594	2,725	1,275	90.5	0.71	8	9.9	17.9	5.2
Luwero	8,539	1,550	6,452	63	0.1	1.1	1.4	2.5	1.34
Masaka/Kalangala	5,963	2,540	3,202	184	0.57	6.4	7.9	14.3	1.35
Rakai	3,889	1,244	2,322	161	0.69	7.8	9.6	17.4	1.73
Mubende/Kiboga	9,821	1,482	7,483	130	0.17	1.9	2.4	4.3	2.06
<b>EASTERN:</b>									
Iganga	4,823	2,949	1,544	92.7	0.6	6.8	8.3	15.1	2.79
Jinja	677	682	0	16.9	N/A	N/A	N/A	N/A	0.7
Kamuli	3,332	1,551	1,770	151	0.85	9.6	11.8	21.4	0.08
Kapchorwa	1,738	432	634	24.4	0.38	4.3	5.3	9.6	3.7
Kumi	2,457	1,771	683	15.6	0.23	2.6	3.2	5.8	0.03
Mbale	2,504	2,477	0	128.9	N/A	N/A	N/A	N/A	6.34
Soroti	8,526	3,022	5,373	22.5	0.04	0.5	0.6	1.1	0.58
Tororo/Pallisa	3,900	3,259	589	166.5	2.83	32	39.3	71.3	0.59
<b>NORTHERN:</b>									
Apac	5,887	2,461	3,304	44.9	0.13	1.5	1.8	3.3	0.65
Arua	7,595	1,525	5,332	120.5	0.22	2.5	3.1	5.6	2.28

REGION/	Total land area 1/ (km <sup>2</sup> )	Estimated area cultivated by 1991 pop'n (km <sup>2</sup> )	Area available for stock (km <sup>2</sup> ) 1/	Recorded livestock numbers 2/ (000s TLU; 1994)	Derived stocking density (TLU/ha)	Gross margin Milk production 3/ (US\$/ha)	Gross margin Meat production 4/ (US\$/ha)	Gross margin Overall livestock (US\$/ha)	PA land Overall opportunity cost 5/ (millions US\$)
Gulu	11,560	1,578	7,681	20	0.03	0.3	0.4	0.7	4.84
Kitgum	16,136	1,812	13,544	22.7	0.01	0.1	0.1	0.2	1.14
Kotido	13,208		<10,308	277.5	0.27	3.1	3.7	6.8	>1.97
Lira	6,151	2,553	3,509	36.1	0.1	1.1	1.4	2.5	0.46
Moroto	14,113		<6,121	416.5	0.68	7.7	9.5	17.2	>13.75
Moyo	4,668	428	3,896	25.1	0.06	0.7	0.8	1.5	0.46
Nebbi	2,781	745	1,934	76.1	0.39	4.4	5.4	9.8	0.42
<b>WESTERN:</b>									
Bundibugyo	2,097	232	816	44.4	0.54	6.1	7.5	13.6	3.89
Bushenyi	4,906	1,838	1,443	113.9	0.79	8.9	11	19.9	12.37
Hoima/Kibaale	7,771	1,248	5,695	84.5	0.15	1.7	2.1	3.8	2.05
Kabale/Kisoro	2,315	1,710	535	76.5	1.43	16.1	19.9	36	2.14
Kabarole	8,109	1,853	4,596	102.6	0.22	2.5	3.1	5.6	6.45
Kasese	2,724	686	555	34.7	0.62	7	8.6	15.6	10.85
Masindi	8,458	869	3,469	37.7	0.11	1.2	1.5	2.7	10.9
Mbarara/Ntungamo	10,587	1,618	8,246	492.7	0.6	6.8	8.3	15.1	1.95
Rukungiri	2,584	1,110	916	62.8	0.68	7.7	9.5	17.2	4.12
<b>TOTALS</b>	<b>197,096</b>	<b>50,976</b>	<b>114,338</b>	<b>3,451.70</b>	<b>0.3</b>	<b>3.4</b>	<b>4.2</b>	<b>7.6</b>	<b>110.6</b>

1/ See Table 1 for derivation

2/ "Economics of crop and livestock production", Agricultural secretariat, Bank of Uganda, 1993/94. Table 8.3

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- 3/ Based on average production of 78.8 litres per TLU (BOU, 1993/94, Table 8.2), average producer price of 300 Ushs per litre; and production costs of 155 UShs per litre (at 1,010 UShs = US\$ 1). Equivalent to gross margin of US\$ 11.31/TLU
  - 4/ Based on average production of 37.9 kg per TLU (BOU, 1993/94, Table 8.2), average farm-gate producer price of 112,500 UShs/TLU, 145 kg beef produced/TLU (58 % dressing out), and average production costs of 139 UShs/kg (BOU, 1993/94, Annexure 21)(at 1,010 UShs = US\$ 1). Equivalent to a gross margin of US\$ 13.86/TLU
  - 5/ Based on average gross margins of US\$ 12,030/km<sup>2</sup>/yr under cultivation, and livestock margins as shown. Assuming all PA land converted to agricultural and livestock production in the proportions recorded in each district.