Poverty and natural resource management in the Central Highlands of Eritrea

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Appendix 1 Summary of the Linear Programming Model

Table A1 Summary of the Linear Programming Model

Parameter	Definition	Values	Parameter	Definition	Values
cland0(s,w)	(14)	§ 7.2	mnencont(v)	(86)	§ A6
tland0(s,w,y)	(14)	§ 7.2	wdencont(y)	(86)	§ A6
pstone(s)	(18)	§ 7.18	krencont	(86)	§ A6
yld(s,w,c,f)	(31)	§ 7.4.2	enreq	(86)	§ 7.7.2
fal	(32)	§ 8.2.	avmlbag(p,t)	(88)	§ 7.3.1
resid(c)	(37)	§ 7.4.2	avmlbal(p,t)	(88)	§ 7.3.1
crestock0(c)	(39)	§ A8	avlbag(p,t)	(88)	§ 7.3.1
popl(t)	(44)	§ 7.3	avlbal(p,t)	(88)	§ 7.3.1
calcont(c)	(44)	§A6	labcult(c,p)	(89)	§ 7.3.2
calreq	(44)	§ 7.8	labcutre (y)	(89)	§ 7.3.2
sdreq(c)	(44)	§ A8	labcons(s)	(89)	§ 7.3.2
popl0	(44)	§ 7.3	labtree(p,y)	(89)	§ 7.3.2
stock0(c)	(44)	§ A8	lablivs(p,v)	(89)	§ 7.3.2
vwtland(s,w,y,tt,t)	(52)	§ 7.7.2	mlab(p,c)	(89)	§ 7.3.2
wdyld(s,w,y)	(52)	§ 7.7.2	cash0	(92)	§ A8
vwtland0(s,w,y)	(52)	§ 7.7.2	bpricec(c,t)	(92)	§A 7
wdstock0(y)	(57)	§ A8	spricec(c,t)	(92)	§ A7
gryld(s,w)	(60)	§ 7.7.1	priceu(t)	(92)	§ A7
gryldw(s,w,y)	(60)	§ 7.7.1	priced(t)	(92)	§ A7
lvstck0(v)	(64)	§ 5.6	bpricev(v,t)	(92)	§ A7
grlvstk(v)	(64)	§ 7.6	spricev(v,t)	(92)	§ A7
feedreq(v)	(67)	§ 7.6	pricem(t)	(92)	§ A7
domcong	(67)	§ A5	bpricew(t)	(92)	§ A7
domconcr	(67)	§ A5	spricew(t)	(92)	§ A7
oxcult(p,c)	(69)	§ 7.3	pricek(t)	(92)	§ A7
oxdays(p)	(69)	§ 7.3	wage(t)	(92)	§ A7
donkday(p)	(71)	§ 7.3	remit(t)	(92)	§ 7.10
wdonkey	(71)	§ 7.3	hhexp(t)	(92)	§ 7.8.1
distf	(71)	§ 7.3	r	(92)	§ A7
Myld(v)	(74)	§ 7.6	erosc(s,w,c,f)	(98)	§ 7.9.2, A1, A2
manyld(v)	(76)	§ 7.6	erost(s,w,y)	(98)	§ 7.9.2
manstock0(v)	(78)	§ A8	ncontf(f)	(100)	§ A5
manurate(f)	(83)	§ 6.4	ncontc(c)	(100)	§ A5
residrate(f)	(83)	§ 6.4	nrain	(100)	§ 7.5.2
urearate(f)	(83)	§ 6.4	nfix	(100)	§ 7.5.2
daprate(f)	(83)	§ 6.4	nfal	(100)	§ 7.5.2
crencont(c)	(86)	§ A6	neros	(100)	§ A6

Table A1. continued

Variables	**Definition**	**Variables**	**Definition**
CLAND(s,w,c,f,t)	(15)	WDSTSOCK(y,t)	(57)
TLAND(s,w,y,tt,t)	(16)	GRASS(t)	(60)
TSTONE(s,p,t)	(19)	LVSTK(v,t)	(64)
CSTONE(s,p,t)	(19)	SELVSTK(v,t)	(64)
TCLAND(s,w,y,tt,p,t)	(20)	BUYLVSTK(v,t)	(64)
TPROD(c,t)	(35)	MILK(t)	(74)
CROPRES(c,t)	(37)	MANURE(v,t)	(77)
CRESFUEL(c,t)	(39)	MANFERT(v,t)	(78)
CRESFEED(c,t)	(39)	MANFUEL(v,t)	(78)
CRESFERT(c,t)	(39)	MANSTOCK(v,t)	(78)
CRESTOCK(c,t)	(39)	BUYUREA(t)	(84)
BUYCROP(c,t)	(44)	BUYDAP(t)	(84)
SELLCROP(c,t)	(44)	KEROSENE(t)	(86)
FOOD(c,t)	(44)	OFFARM(p,t)	(89)
SEED(c,t)	(44)	CASHBAL(t)	(92)
STOCK(c,t)	(44)	CREDIT(t)	(92)
WDHARV(s,w,y,t)	(52)	PAYCREDIT(t)	(92)
TVWDWDL(y,t)	(52)	INTEREST(t)	(92)
WDFUEL(y,t)	(57)	TSLOSS(t)	(98)
SELLWOOD(y,t)	(57)	NBAL (t)	(100)
BUYWOOD(y,t)	(57)		

Table A1. continued

$$\text{Max } Max\sum_{t}(1/(1+r))^{t}\times NETBENEFIT(t) \tag{103}$$

$$\begin{aligned}NETBENEFIT(t) = {} & \sum_{c} spricec(c,t)\times SELLCROP(c,t) - \sum_{c} bpricec(c,t)\times BUYCROP(c,t)\\ & + \sum_{v} spricev(v,t)\times SELLIVSTCK(v,t) - \sum_{v} bpricev(v,t)\times BUYLIVSTCK(v,t)\\ & + \sum_{v} spricev(v,t)\times[LVSTK(v,t) - LVSTK(v,t-1)]\\ & + \sum_{y} spricew(y,t)\times SELLWOOD(y,t) - \sum_{y} bpricew(y,t)\times BUYWOOD(y,t)\\ & + \sum_{y} spricew(y,t)\times[VWDWDL(y,t) - VWDWDL(y,t)]\\ & + pricem\times MILK(t) + wage\times OFFARM(t)\\ & - priceu(t)\times BUYUREA(t) - priced(t)\times BUUDAP(t) - pricek(t)\times KEROSENE(t)\end{aligned} \tag{102}$$

$$\begin{aligned}\sum_{y} TLAND(s,w_1,y,t,t) + \sum_{c,f} CLAND(s,w_1,c,f,t) = {} & \sum_{c,f} CLAND(s,w_1,c,f,t-1)\\ & + (1-pstone(s))\times\sum_{p}\{CSTONE(s,p,t) + TSTONE(s,p,t)\}\\ & + \sum_{y,p}\sum_{tt=0}^{t-1} TCLAND(s,w_1,y,tt,p,t)\end{aligned} \tag{26}$$

$$\begin{aligned}\sum_{y} TLAND(s,w_0,y,t,t) + \sum_{c,f} CLAND(s,w_0,c,f,t) = {} & \sum_{c,f} \mathrm{CLAND}(s,w_0,c,f,t-1)\\ & - \sum_{p}\{CSTONE(s,p,t) + TSTONE(s,p,t)\}\\ & + \sum_{y,p}\sum_{tt=0}^{t-1} TCLAND(s,w_0,y,tt,p,t)\end{aligned} \tag{28}$$

$$TLAND(s,w,y,tt,t) = TLAND(s,w,y,tt,t-1) - \sum_{p} TCLAND(s,w,y,tt,p,t) \tag{24}$$

$$TLAND(s,w,y,0,1) = tland0(s,w,y) - \sum_{p} TCLAND(s,w,y,0,p,t) \tag{25}$$

$$\sum_{p} CSTONE(s,p,t) \le \sum_{c,f} CLAND(s,w_0,c,f,t-1) \tag{21}$$

$$TSTONE(s,p,t) \le \sum_{y,tt} TCLAND(s,w_0,y,tt,p,t) \tag{22}$$

$$CLAND(s,w,c_6,f_0,t) = \sum_{c,f} \mathrm{fal}\times CLAND(s,w,c,f,t) \tag{33}$$

Table A1. continued

$$TPROD(c,t) = \sum_{s,w,f} yld(s,w,c,f,t) \times CLAND(s,w,c,f,t) \quad (36)$$

$$\begin{aligned} \text{CRESTOCK(c, t)} = \text{CRESTOCK(c, t - 1)} + \text{CROPRES(c, t)} - \text{CRESFUEL(c, t)} \\ - \text{CRESFEED(c, t)} - \text{CRESFERT(c, t)} \end{aligned} \quad (40)$$

$$CRESFERT(c,t) \le CRESTOCK(c,t-1) \quad (42)$$

$$\sum_{c=1}^{5} calcont(c) \times FOOD(c,t) \ge calreq \times popl(t) \quad (45)$$

$$SEED(c,t) = \sum_{s,f,w} sdreq(c) \times CLAND(c,s,f,w,t) \quad (46)$$

$$\begin{aligned} STOCK(c,t) = STOCK(c,t-1) + PROD(c,t) + BUYCROP(c,t) \\ - SELLCROP(c,t) - FOOD(c,t) - SEED(c,t) \end{aligned} \quad (47)$$

$$SEED(c,t) \le STOCK(c,t-1) + BUYCROP(c,t) \quad (49)$$

$$WDHARV(s,w,y,t) = \sum_{tt=0}^{t} \{ vwtland(s,w,y,tt,t) \times \sum_{p} TCLAND(s,w,y,tt,p,t) \} \quad (55)$$

$$TVWDWDL(y,t) = \sum_{s,w,tt} vwtland(s,w,y,tt,t) \times TLAND(s,w,y,tt,t) \quad (56)$$

$$\begin{aligned} WDSTOCK(y,t) = WDSTOCK(y,t-1) + \sum_{s,w} WDHARV(s,w,y,t) \\ + BUYWOOD(y,t) - SELLWOOD(y,t) - WDFUEL(y,t) \end{aligned} \quad (58)$$

$$\begin{aligned} GRASS(t) = \sum_{s,w} gryld(s,w) \times \{ CLAND(s,w,c_6,f_0,t) + CLAND(s,w,c_7,f_0,t) \} \\ + \sum_{s,w,y,tt} gryldw(s,w,y) \times TLAND(s,w,y,tt,t)) \end{aligned} \quad (61)$$

$$\begin{aligned} LVSTK(v,t) = (1 + grlvstk(v)) \times [LVSTK(v,t-1) + BUYLVSTK(v,t) \\ - SELLVSTK(v,t)] \quad \text{for t} > 1 \end{aligned} \quad (65)$$

$$\sum_{v} feedreq(v) \times LVSTK(v,t) \le domcong * GRASS(t) + \sum_{c} domconcr * CRESFEED(c,t) \quad (68)$$

$$\sum_{c,s,f,w} oxcult(p,c) \times CLAND(c,s,f,w,t) \le oxdays(p) \times LIVESTOCK(v_1,t) \quad (70)$$

$$\begin{aligned} \sum_{p=12}^{18} LIVSTCK(v_3,t) \times donkday(p) \times wdonkey \ge \sum_{c} CROPRES(c,t) \times distf \\ + \sum_{c} PROD(c,t) \times wdonkey \end{aligned} \quad (72)$$

$$\sum_{p=2}^{6} LIVSTCK(v_3,t) \times donkday(p) \times wdonkey \ge MANFERT(v,t) \times distf \quad (73)$$

$$\sum_{v} myld(v) \times LVSTK(v,t) = MILK(t) \quad (75)$$

Table A1. continued

$$MANURE(v,t) = manyld(v) \times LVSTK(v,t) \tag{77}$$

$$MANSTOCK(v,t) = MANSTOCK(v,t-1) + MANURE(v,t) - MANFERT(v,t) - MANFUEL(v,t) \tag{79}$$

$$MANFERT(v,t) = MANSTOCK(v,t-1) + 0.5 * MANURE(v,t) \tag{81}$$

$$\sum_{v} MANFERT(v,t) = \sum_{s,w,c,f} manurate(f) \times CLAND(s,w,c,f,t)$$

$$\sum_{c} CRESFERT(c,t) = \sum_{s,w,c,f} residrate(f) \times CLAND(s,w,c,f,t)$$

$$BUYUREA(t) = \sum_{s,w,c,f} urearate(f) \times CLAND(s,w,c,f,t) \tag{85}$$

$$BUYDAP(t) = \sum_{s,w,c,f} daprate(f) \times CLAND(s,w,c,f,t)$$

$$\begin{aligned} enreq * popl(t) \le & \sum_{c} crencont(c) \times CRESFUEL(c,t) \\ & + \sum_{v} mnencont \times MANFUEL(v,t) \\ & + \sum_{y} wdencont(y) \times WDFUEL(y,t) \\ & + krencont \times KEROSENE(t) \end{aligned} \tag{87}$$

$$\begin{aligned} & \sum_{c,s,f,w} labcult(c,p) \times CLAND(c,s,f,w,t) \\ & + \sum_{s} (labcons(s) \times [CSTONE(s,p,t) + TSTONE(s,p,t)]) \\ & + \sum_{tt=0}^{t-1} \sum_{s,w,y} labcutr(y) \times TCLAND(s,w,y,tt,p,t) \\ & + \sum_{s,w,c,f} (labfert(p,f) \times CLAND(s,w,c,f,t) \\ & + \sum_{v} labliv(v,p) \times LIVSTK(v,t) + \sum_{s,w,y} labtree(y,p) \times TLAND(s,w,y,t,t) \\ & \le avlbal(p,t) - OFFARM(p,t) \end{aligned} \tag{90}$$

$$\sum_{c,s,f,w} mlab(p,c) \times CLAND(c,s,f,w,t) \le avmlbag(p,t) - OFFARM(p,t) \tag{91}$$

Table A1. continued

$$CASHBAL(t) = CASHBAL(t-1) + \sum_{c} spricec(c,t) \times SELLCROP(c,t) + \sum_{v} spricev(v,t) \times SELLLIVSTC(v,t) + \sum_{y} pricew(y,t) \times SELLWOOD(y,t) + \sum_{p} OFFARM(p,t) \times wage(t) + CREDIT(t) + pricem(t) \times milk(t) + remit(t) - \sum_{c} bpirce(c,t) \times BUYCROP(c,t) - \sum_{V} bprice(v,t) \times BUYLIVSTC(v,t) - \sum_{y} bpricew(y,t) \times BUYWOOD(y,t) - pricek(t) \times KEROSENE(t) - priceu(t)*BUYUREA(t) - priced(t) \times BUYDAP(t) - PAYCREDIT(t) - hh\exp(t) * POPL(t) \quad (93)$$

$$CREDIT(t) = 0 \text{ for t = T-1, T-2} \quad (96)$$

$$INTEREST(t) = \sum_{\tau=t-3}^{\tau=t-1} r \times Credit(\tau) \quad (97)$$

$$TSLOSS(t) = \sum_{s,w,c,f} erosc(s,w,c,f) \times CLAND(c,s,f,w,t) + \sum_{s,w,y,tt} erost(s,w,y) \times TLAND(s,w,y,tt,t) \quad (99)$$

$$NBAL(t) = \left(\sum_{s,w,c,f} CLAND(s,w,c,f,t) * ncontf(f)\right) / \sum_{s,w,c,f} CLAND(s,w,c,f,t) + nrain + nfix + nfal - \left(\sum_{s,w,c,f} ncontc(c) * CLAND(s,w,c,f,t)\right) / \sum_{s,w,c,f} CLAND(s,w,c,f,t) \quad (101)$$

$$\_\left(\sum_{s,w,c,f} neros * erosc(s,w,c,f,t) * CLAND(s,w,c,f,t)\right) / \sum_{s,w,c,f} CLAND(s,w,c,f,t)$$

Appendx 2 Crop Yield and Soil Loss Functions for Maiaha and Zibanuna villages

Table A2. Cobb-Douglas yield functions (coefficients and t-statistics using Ordinary Least Square regression) Maiaha village

	Barley		Millet		Beans		Sorghum		Wheat	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	3.6685***	44.67	3.8417***	12.64	3.8079***	26.12	3.3601***	26.39	3.4943***	29.23
ln (N)	0.8379***	28.73	0.4601***	2.93	0.8170***	11.04	1.1121***	37.63	0.8747***	19.42
ln (P)	0.1303***	6.45	0.0819*	2.51	0.1968***	6.56	0.0210	1.40	0.0809*	2.13
Mulch	0.0002***	12.52	0.0004***	12.23	0.0014***	15.47	0.0002**	14.37	0.0002***	11.15
Bund	0.20350***	9.63	0.4479***	10.35	0.5277***	10.54	0.1859***	8.09	0.2159***	7.95
STYPE2	-0.1947***	-4.71	-0.6337***	-3.52	0.5599***	-8.53	-0.0730	-0.76	-0.1424*	-2.11
STYPE3	-0.3912***	-12.00	-1.2553***	-8.79	-0.9824***	-11.82	-0.3718***	-4.84	-0.4391***	-10.25
STYPE4	-0.7597***	-20.10	-2.1837***	-22.64	-1.4567***	-12.12	-0.7739***	-10.52	-0.9511***	-24.36
No. observ.	144		144		144		144		144	
Adj. R^2	0.96		0.95		0.83		0.95		0.94	
D-W stat	1.40		2.12		1.85		2.07		1.46	

The dependent variable is log(yield). The first three variables are also in logarithm.

D-W Stat is the Durbin-Watson Statistics

* P < 0.05 ** P < 0.01 *** P < 0.001

Table A3. Cobb-Douglas yield functions (coefficients and t-statistics using Ordinary Least Square regression) Zibanuna village

	Barley		Millet		Beans		Sorghum		Taff	
	Coefficient	t-stat	Coefficient	t-stat	5.2560***	73.36	Coefficient	t-stat	Coefficient	t-stat
C	4.8513***	29.26	3.9644***	18.38	0.1066**	3.12	5.0399***	21.04	4.6784***	24.72
ln (N)	0.4871***	5.32	0.6341***	7.22	0.3523***	12.81	0.4960***	5.01	0.5212***	5.26
ln (P)	0.1701*	2.56	0.0003	0.009	0.0008***	9.18	0.1503*	2.24	0.1228	1.68
Mulch	0.0001***	12.14	0.0001***	12.67	0.2181***	5.25	0.0001***	14.59	0.0001***	11.39
Bund	0.1326***	6.45	0.2745***	8.71	-0.2861***	-7.00	0.0697**	3.35	0.1785***	7.00
STYPE2	0.0627***	3.89	-0.06808*	-2.05	-0.1908***	-4.53	0.0058	-0.29	0.0030	0.14
STYPE3	-0.0920**	-3.26	-0.1535***	-7.25	-0.7393***	-10.10	-0.4379***	-10.22	-0.1459***	-4.12
STYPE4	-1.0803***	-10.74	-0.6552***	-12.48	5.2560***	73.36	-0.7212	-16.56	-1.5310***	-13.66
No. observ.	144		144		144		144		144	
Adj. R^2	0.98		0.89		0.96		0.97		0.97	
D-W stat	1.98		2.43		1.65		1.73		2.05	

The dependent variable is log(yield). The first three variables are also in logarithm.

D-W Stat is the Durbin-Watson Statistics

* P < 0.05 ** P < 0.01 *** P < 0.001

Table A4. Soil loss functions (coefficients and t-statistics using Ordinary Least Square regression) Maiaha village

	Barley		Millet		Beans		Sorghum		Wheat	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	2.9169***	42.95	2.9684***	20.10	2.3064***	34.86	3.1181***	22.87	3.0032***	40.32
ln(N)	-0.2981***	-12.39	-0.4243***	-7.97	-0.1613***	-4.73	-0.5256***	-16.62	-0.3409***	-13.57
ln(P)	-0.0052	-0.31	-0.0224	-0.81	-0.0194	-0.87	-0.0101	-0.6290	-0.0036	-0.23
Mulch	-0.0003***	-23.26	-0.0003***	-8.82	-0.0005***	-9.42	-0.0003***	-18.20	-0.0003***	-32.34
Bund	-0.4685***	-26.82	-0.5695***	-16.73	-0.5012***	-22.54	-0.5328***	-21.67	-0.4690***	-26.64
STYPE2	1.5663***	45.85	1.5815***	10.04	1.6257***	38.12	1.6259***	15.96	0.5677***	43.48
STYPE3	1.4744***	12.88	0.4195***	3.357	0.4325***	11.24	0.3957***	4.82	0.3495***	12.79
STYPE4	0.7197***	23.83	0.9221***	11.89	0.8247***	30.50	0.8288***	10.53	0.7283***	25.00
No. observ.	144		144		144		144		144	
Adj. R^2	0.98		0.97		0.96		0.97		0.98	
D-W stat	3.65		3.90		3.30		3.66		3.56	

The dependent variable is log (yield). The first three variables are also in logarithm.
D-W Stat is the Durbin-Watson Statistics
* P < 0.05 ** P < 0.01 *** P < 0.001

Table A5. Soil loss function (coefficients and t-statistics using Ordinary Least Squares regression) Zibanuna village

	Barley		Millet		Beans		Sorghum		Wheat	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
C	3.1551***	57.74	3.1422***	34.78	2.6569***	132.49	1.3436***	4.02	3.1372***	57.46
ln(N)	-0.1799***	-7.19	-0.3608***	-9.81	-0.0104	-1.1983	-0.5000***	-4.39	-0.1845***	-7.51
ln(P)	-0.0648***	-3.81	-0.0065	-0.43	-0.0844***	-9.66	-0.5494	-11.87	-0.0638	-3.98
Mulch	-0.0003***	-48.72	-0.0003***	-45.72	-0.0003***	-9.31	-0.0004***	-9.39	-0.0003***	-57.74
Bund	-0.6670***	-59.05	-0.5735***	-43.47	-0.6733***	-49.67	-0.5392***	-6.31	-0.6613***	-58.73
STYPE2	0.6072***	39.47	0.6130***	44.19	0.5858***	28.60	0.3165***	3.30	0.6047***	40.18
STYPE3	1.4757***	89.91	1.4905***	42.27	1.4969***	68.70	1.5380***	43.15	1.4761***	90.52
STYPE4	1.5818***	0.4668	1.7351***	30.93	1.5295***	45.91	1.7626***	30.38	1.5604***	46.60
No. observ.	144		144		144		144		144	
Adj. R^2	0.99		0.99		0.99		0.78		0.99	
D-W stat	3.22		3.10		1.90		0.87		3.17	

The dependent variable is log (soil loss). The first three variables are also in logarithm.
D-W Stat is the Durbin-Watson Statistics
* P < 0.05 ** P < 0.01 *** P < 0.001

Appendix 3 Nutrient and Energy Related Data, Prices and Initial Values of Some Parameters

Table A6. Nutrients and Energy-related data*

Items	Plant nutrients (kg/ton)			Energy content of crops (kcal/kg)	Yield of crop residues (kg/kg of crop)	Feed nutrients (ton DM /ton of residues)	Primary energy (mj/kg)	Cooking efficiency (%)
	N	P	K					
UREA	460	0	0	-	-	-	-	-
DAP	190	460	0	-	-	-	-	-
Fuelwood	-	-	-	-	-	-	16.6	8
Dung	15	7.5	10	-	-	-	8.4	9
Crop and residues								
Barley	22.1	7.6		3540	1.2	0.5	12.5	8
Millet	30.7	10.1		3780	1.2	0.5	12.5	8
Pulses	29.2	17.5		3690	0.8	0.5	12.5	8
Sorghum	25.5	11.1		3390	1.2	0.5	12.5	8
Wheat	28.7	13.9		3540	1.0	0.5	12.5	8
Taff	28.7	13.9		3390	1.0	0.5	12.5	8
Kerosene	_	-	-	-	-	-	43.19	42
grass	-	-	-	-	-	0.3	-	-

* It is assumed that 1 kg of N is lost for every ton of soil loss (Smaling 1990).

Source: FAO, 1997; Newcombe, 1989; MOEM, 2000; Hanao, 1999

Table A7. Buying and selling prices used in the model

	Embaderho		Zibanuna		Maiaha	
	Buying	Selling	Buying	Selling	Buying	Selling
Crops (100 kg)						
Barley	315	255	315	225	330	195
Millet	704	570	704	503	737	436
Pulses	630	510	630	450	660	390
Sorghum	315	255	315	225	330	195
Wheat	473	383	473	338	495	293
Taff	1155	935	1155	825	1210	715
Livestock (unit)	0	0	0	0	0	0
Oxen	3150	2550	3150	2250	3300	1950
Cattle	2625	2125	2625	1875	2750	1625
Donkeys	840	680	840	600	880	520
Sheep/Goat	420	340	420	300	440	260
	315	255	315	225	330	195
Fuelwood (100 kg)	840	680	840	60	880	520
Kerosene (litre)	4.25		4.25		4.25	
Milk (litre)	2.5		2.5		2.5	
Wage (person/day)	40		40		40	

Source: Based on market prices in 2002 and marketing costs discussed in Chapter eight.

Table A8 Initial values of some parameters

	Embaderho	Maiaha	Zibanuna
stock0(c) (kg)	84000	11400	16200
crestock0(c) (kg)	840	114	162
wdstock0(c) (kg)	0	0	0
manstock0(v) (g)	30,20,10,50	30,20,10,50	30,20,10,0
cash0 (Nakfa)	0	0	0
sdreq(c) (kg)	150, 50, 50, 50, 150, 50 for barley, millet, pulses, sorghum, wheat and taff respectively.		

Fig A1. Prices of cereals and pulses in Asmara (Nakfa/100kg)

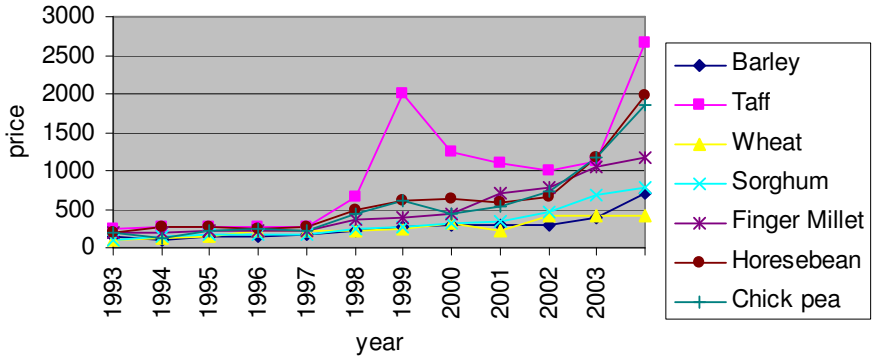
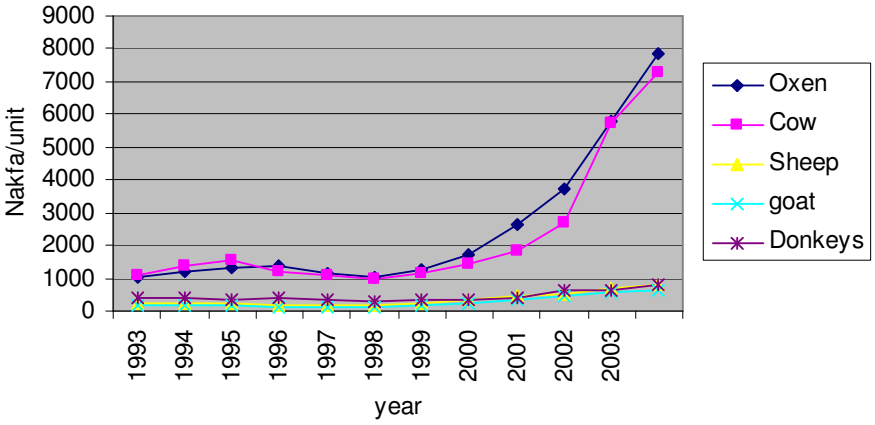


Figure A2. Evolution of livestock prices 1993-2003



Appendix 4 Results of Sensitivity Tests on Fuelwood Prices and Discount Rates

Figure A3. Simulated areas of eucalyptus plantations under different wood prices in Embaderho

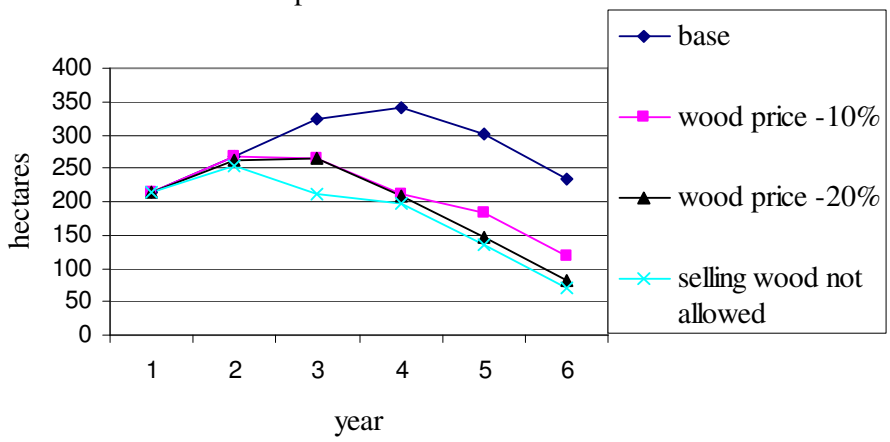


Figure A4. Simulated areas of eucalyptus plantations under different rates of discount in Embaderho

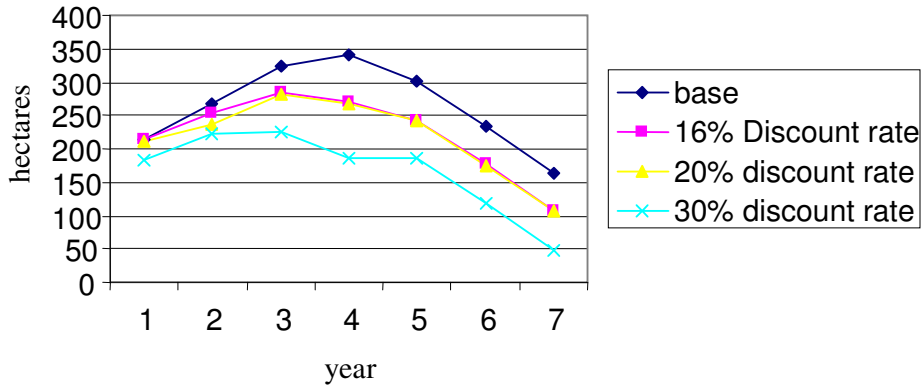


Figure A5 Simulated areas of eucalyptus plantations under different wood prices in Maiaha

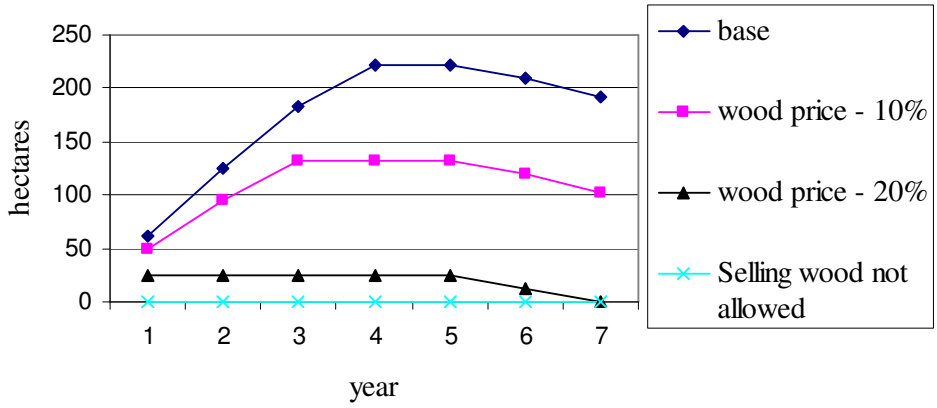


Figure A6. Simulated areas of eucalyptus plantations under different rates of discount in Maiaha