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Agricultural Economy of an Upland Community: Twelve-year (1994-2006) Trend in Bukidnon, Philippines[1]

By:

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Abstract

This paper chronicles the trends in the indicators of the agricultural economy in the upland community of Lantapan, Bukidnon, which was the site of a long term study investigating agricultural sustainability. Collection of the panel data started in 1994; the latest data set collected refers to 2006. From 1994 to 2002, the focus of the surveys was to understand the environmental effect of economic policies. The 2006 survey aimed at further monitoring these impacts especially from a climate vulnerability perspective. The crop year 2006 was characterized as a La Nina period in the Philippines.

From a total of 306 plots and 190 households in 1994, the 2006 plots numbered 107 and the corresponding households numbered 80. The decrease in the number of respondents was due to demographic factors such as deaths and migration. The farmers who went out of farming in previous years were revisited and thus, we were able to capture the reversal of households going back to farming after 2002.

Our results showed that agricultural intensification is still going on; more vegetables production in the upper watershed was observed; bananas and coffee were popular crops. Yields of crops were also seen to be rising from the year 2000 level. Coffee price which was declining during the earlier period was seen to be on an upward trend in 2006. In terms of gross and net incomes, it was seen that white corn production is more profitable in 2006 than yellow corn production. White corn remains to be the staple crop in the area and local demand is increasing because most farmers cultivate commercial crops. This has influenced the higher price of white corn relative to yellow corn in the later period.

The share of farm income to total income is still on the decline, except for vegetable producing households where the share of farm income was about 60% of the total household incomes. Based on trends observed during 2002 to 2006, it can be seen that upland agriculture was not affected by the La Nina. The amount of rains in this upland area even resulted to increased yields of traditional crops such as corn.

I. INTRODUCTION

1 Funds for the data collection were from the USAID's SANREM CRSP Phases I, II and III. SANREM Phase III project was made possible through support provided by the United States Agency for International Development (USAID) and the generous support of the American people for the Sustainable Agriculture and Natural Resources Management Collaborative Research Support Program (SANREM CRSP) under terms of Cooperative Agreement Award No. EPP-A-00-04-00013-00 to the Office of International Research and Development (OIRED) at Virginia Polytechnic Institute and State University (Virginia Tech); and terms of sub-award agreement 19070A-425632 between Virginia Tech and North Carolina Agricultural and Technical State University (NCA&T).

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This paper describes the long term trend of an agricultural economy of an upland community. The data came from a set of households who were visited since 1994. The latest data came from a 2006 survey done among 80 farm households in Lantapan, Bukidnon, which constitute what remains of the original 190 households in 1994. In that initial year, the purpose of the study was to understand factors affecting farmers' land and labor use decisions. Through this data set, researchers were able to describe nature of farmers' land use decisions in response to climate variability, as well as economic policies.

The interest of the 2006 survey was to monitor the land and labor use decisions and the corresponding income effects of farm households in the context of a climate phenomenon referred to as the La Nina that characterized the country during the last quarter of 2005 towards the first quarter of 2006. The 2006 data in this paper refers to 2006 dry season (January to June, 2006) production. Labor trends analysis is reported in Rola et al. 2007.

II. METHODOLOGY

Socio-economic benchmark data at the plot and household levels in Lantapan, Bukidnon were first gathered in 1994. The sampling procedure is reported in Coxhead (1995). Annual surveys were henceforth done until 2002. No data collection took place until 2006.

The number of respondent plots decreased during the period of the study. In 1994, there were 306 plots in the sample; this declined to 174 in 1998 and only 164 in the year 2002 (**Table 1**). In 2006, this was 107. Reasons for the decline include plots having been given back to the owners; farmers stopped farming as plots were rented out; or farmer-respondents migrated. The number of household respondents also declined through time, from 190 in 1994 to 80 in 2006. This is what remains in the municipality of the original household respondents in the 1994 survey.

Table 1. Number of respondents and plots, 1994-2006, Lantapan, Bukidnon, Philippines.

	1994	1996	1998	2000	2002	2006
No. of Households	190	117	93	84	109	80
No. of Plots	306	252	174	117	164	107

A standard cost and returns analysis is used in this paper as a framework in the analysis of agricultural production in the study site. Net farm income is derived as the remainder of the gross farm income less the cash cost of production. This represents the returns to family labor and land rent. Gross income is the product of the yield of the crop and the farm price of that crop. Cash costs are costs of seeds, fertilizers, pesticides, labor and other managerial and machine costs.

Household income trends are also analyzed to determine the structural transformation of the agricultural economy in the uplands.

III. RESULTS AND DISCUSSION

III.1. The Study Site

The municipality of Lantapan[3] is contained wholly within the Upper Manupali River watershed, which runs west from a point about 15 km south of Malaybalay City along the southern boundary of the Mount Kitanglad Range Nature Park. Lantapan's landscape climbs from river flats (300-600m) through a rolling middle section (600-1100m) to high-altitude, steeply sloped mountainsides (1100m-2900m). Soils and rainfall patterns are typical for Mindanao uplands. The municipality consists of several sub-watersheds draining south or southeast from the Mt. Kitanglad range to the Manupali river. In the lower part of the municipality, the river runs into a dam which diverts flow into a network of canals comprising the Manupali River Irrigation System (MANRIS), a 4,000 hectare system constructed by the National Irrigation Authority in 1987. The entire system ultimately drains into the Pulangi River, one of the major waterways of Mindanao Island, about 50 kilometers upstream from the Pulangi IV hydroelectric power generation facility, one of the six largest hydro power generating plants in the country.

As in other upland areas of the country, Lantapan's population has risen since 1980 at an annual average of 4%, much higher than the Philippine average of 2.4%. In spite of rapid growth in recent decades, agriculture continues to dominate the economy of the municipality and of the province. However, agriculture is growing to be more agribusiness type, with the flourishing banana plantations in the study site.

Lantapan's agricultural land area in 1980 totaled 14,400 hectares, more than half of which was classified as being under temporary crops. A small fraction of this, at the eastern boundary of the municipality, is irrigated for rice production. The lower footslopes produce corn and sugarcane, and corn is the dominant crop in the upper footslopes that make up the largest area of the watershed. Coffee is an important secondary crop at middle altitudes, while at higher elevations, corn is planted alongside both coffee and temperate-climate vegetables such as: beans, tomatoes, cabbages and potatoes.

Agricultural expansion in recent decades has largely involved the replacement of forest and permanent crops by annual crops. In recent years, these annual cereal crops are replaced by commercial crops such as sugarcane, banana and vegetables. Over the twenty-years to 1994 the area of permanent forest shrank from about one half to a little over one fourth of total area. Part of the converted land went into shrubs or secondary forest, but most was converted to annual crops, which expanded from 20% to 40% of total land area. Land conversion has also meant the spread of annual cropped area into higher-altitude areas, and into more steeply sloping lands. These patterns are consistent

[3] *For almost a decade, this town has been the focus of intensive data gathering, analysis and action at farm, community, project and local government levels. Many of these have taken place under the auspices of a single project, the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP).*

with the history of agricultural expansion in many other Philippine watersheds and elsewhere in the humid tropics.

III.2. Trends in Crop Area and Cropping patterns

In terms of land use, agriculture has remained to be have the largest share in Lantapan (**Table 2**). This was almost constant at 53% from 1994 to up to 2006.

Dominant cropping pattern in the lower watershed in 1994 was corn-corn, corn-coffee, and corn sugarcane. In the upper watershed, vegetable production was dominant. Our data shows that this trend has been changing through time. Corn area is declining so with coffee area, and vegetable production in the upper watershed is getting to be

Table 2. Land use pattern (%), Lantapan, Bukidnon, 1994, 2001 and 2002.

Classification	1994	2001	2002	2006
Agriculture	53.42	53.83	53.41	53.45
Forestal (pasture, grasslands and forest lands)	40.9	36.96	40.89	40.85
Built-up areas (commercial, residential, agro-Industrial)	5.68	11.35	5.70	5.69
Others	-	3.53		
Total	100	100	100	100
Total (ha)	31,820	32,971	31,827	31,853

Sources: Municipal Annual Reports, 1994, 2001,and 2006,Lantapan, Bukidnon.

intensive. In 2006, a new cropping pattern found in the lower watershed is coffee-banana (**Table 3**). Small farmers now produce banana in commercial quantity, even as the plantation bananas are also expanding in area planted in the municipality.

Table 3. Dominant cropping patterns in Lantapan, Bukidnon, 1994 and 2006.

Location	1994	2006
Lower watershed	Corn-corn Corn-coffee Coffee Corn and sugarcane Veg/corn	Corn-corn Corn-coffee Coffee Corn and sugarcane Sugarcane Coffee and banana
Upper watershed	Corn-corn Veg/corn Veg-veg Corn and coffee Coffee	Corn-corn Veg/corn Veg-veg Corn and coffee

This shift is seen in the number of households engaging in this cropping pattern **(Table 4**). Out of 80 households interviewed in 2006, 9% plant coffee and bananas. This cropping pattern was not observed in the earlier years.

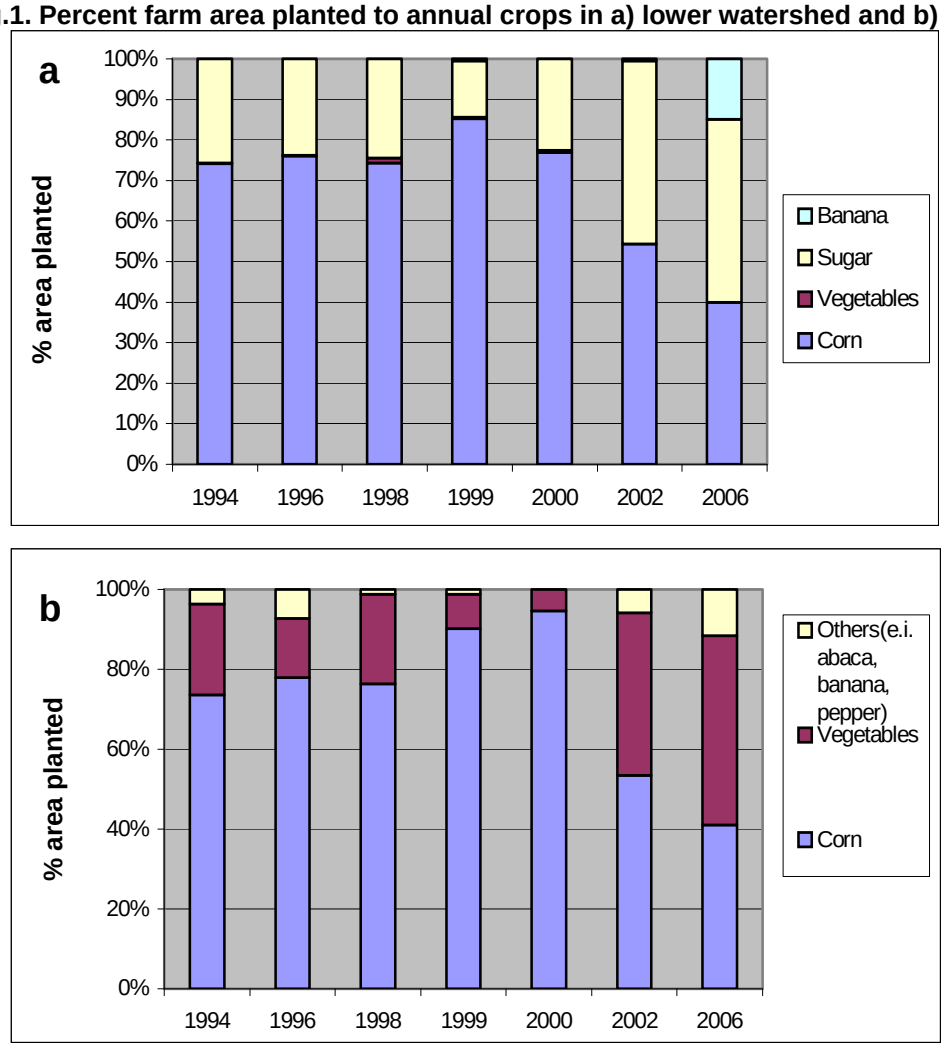
Table 4. Frequency distribution (%) of farming households by cropping pattern and location, 1994 to 2006.

Location	Cropping Pattern	1994	1998	2002	2006

		n=190	*n=93*	*n=109*	*n=80*
Lower watershed	Corn-corn	11	10	7	9
	Corn-coffee	9	13	6	8
	Coffee	7	10	4	6
	Veg-corn	1	3	6	-
	Corn and sugarcane	4	2	4	4
	Sugarcane	-	1	3	4
	Coffee and banana	-	-	-	9
	No crop	-	5	8	3
Upper watershed	Corn-corn	18	24	16	13
	Coffee	4	-	-	-
	Veg-corn	22	13	15	5
	Veg-veg	18	11	19	19
	Rice, timber	-	1	3	-
	Corn and coffee	5	5	-	21
	No crop	-	2	10	1
	Total	100	100	100	100

Individual crop area trend also show that in both the lower and the upper watershed, corn area is declining, sugar and other crops especially bananas has increasing area trend. In the upper watershed, vegetable area is definitely increasing (**Figure 1**). The shift from cereal to commercial crops is now distinct and the choice of semi- perennial crops will be conducive to the environment in the log-term.

Fig.1. Percent farm area planted to annual crops in a) lower watershed and b) upper



III.3. Production and Yield Trends

III.3.1. Yield Trends

Corn

In the Philippines, corn is second to rice in terms of economic importance. Public and private sector research and development investments have been significant. New varieties and better management of corn have resulted to an increasing trend in yields. In the study area, corn yield performance differs in lower and upper watershed. Yield also varies according to its variety and crop management applied. Generally, corn yield was higher in lower watershed than in upper watershed **(Figure 2a and 2b)**. However, as seen in the 2006 household survey, corn yield in lower watershed was only few kilograms higher than in upper watershed for both varieties, yellow and white corn. This could indicate that corn farmers in upper watershed have already applied intensive farming techniques in their farm like use of fertilizers and pesticides.

Our data suggests that corn in the study site have not been affected by heavy rain experienced during early part of 2006. Yields were higher in 2006 than in 2002. This was also in contrast with the yield reported during the drought years of 1997 to 1998 where it experienced the lowest yield particularly for yellow corn.

Coffee

In both watersheds, yield of coffee portrayed an increasing trend after the drought year of 1998 **(Fig. 2c)**. However, fluctuating prices of coffee in both local and international market has influenced the farmers to limit their coffee production and give way to other high value crops, vegetables in upper watershed and banana in lower watershed. This has also reduced the number of farmers venturing in coffee production.

Cabbage

Like the previous years, yield of cabbage continually increased in 2006. Cabbage production only dropped during 1998 because of the drought in the area.

III.3.2. Output Price Trends

Corn

Throughout the years, the farm gate price of white corn is relatively stable as compared to yellow corn for both watershed locations (**Fig. 3a**). Price of white corn has

an increasing trend in 2006, unlike the price of yellow corn which was even declining in 2006. Key informants say that white corn is in demand as more farmers go into commercial crops production.

Coffee

Price of coffee for both watersheds has decreasing trend until 2002. It was only in 2006 where price of coffee rose (**Fig. 3b**). Coffee farmers in lower watershed gained higher price for their coffee as compared to farmers in upper watershed.

Cabbage

Generally, price of cabbage showed stability from 1994 to 2006 except in 1998 (**Fig.3c**) when because of the foul weather, cabbage production was dismal. As expected, because of the limited supply of cabbage in 1998 due to drought, price of cabbage increased. It went back to its normal level in 2000 and steadily increased until 2006.

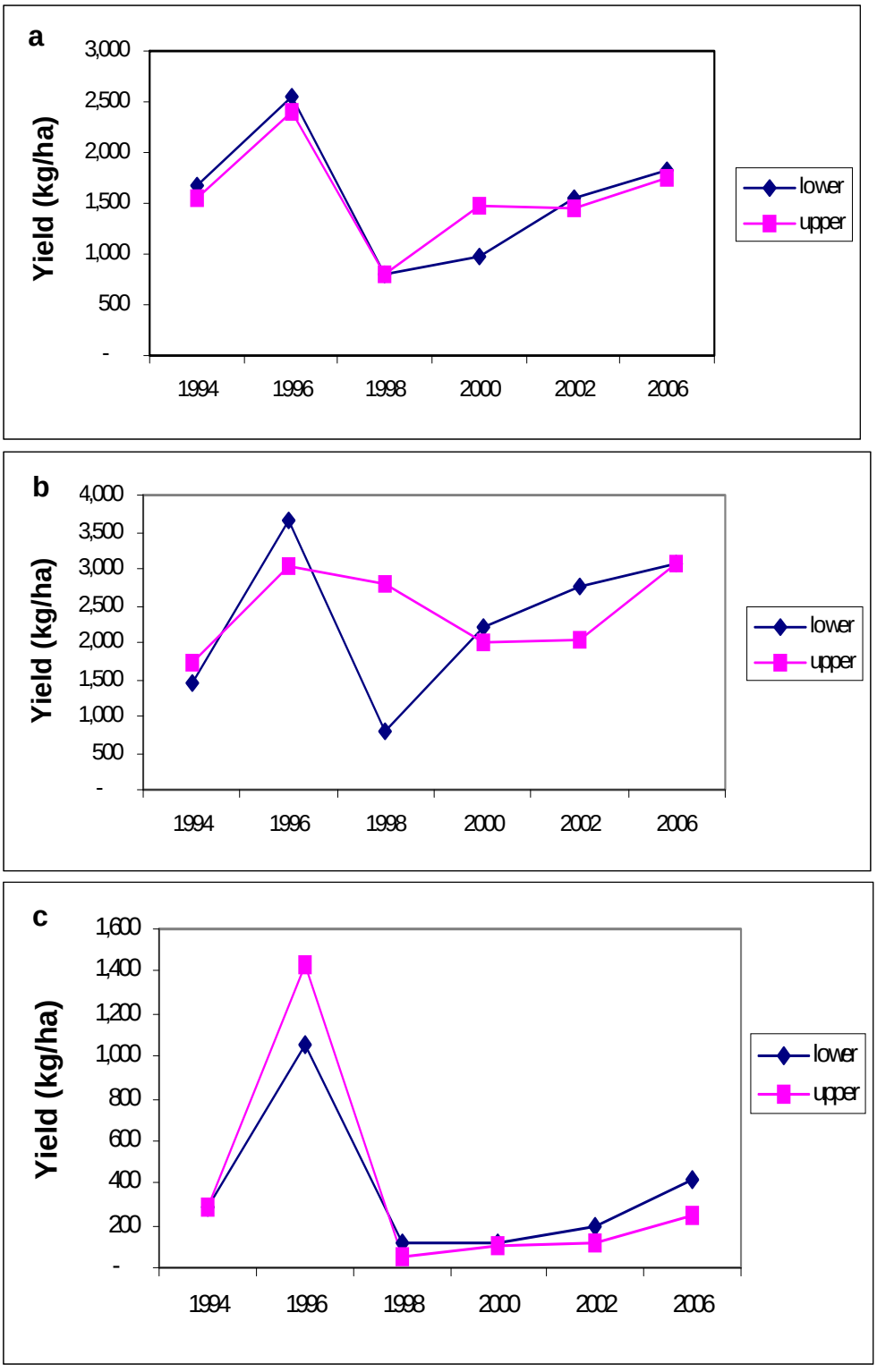


Fig. 2. Trends in yield (kg/ha) of a) white corn, b) yellow corn, and c) coffee, by location, 1994 to 2006

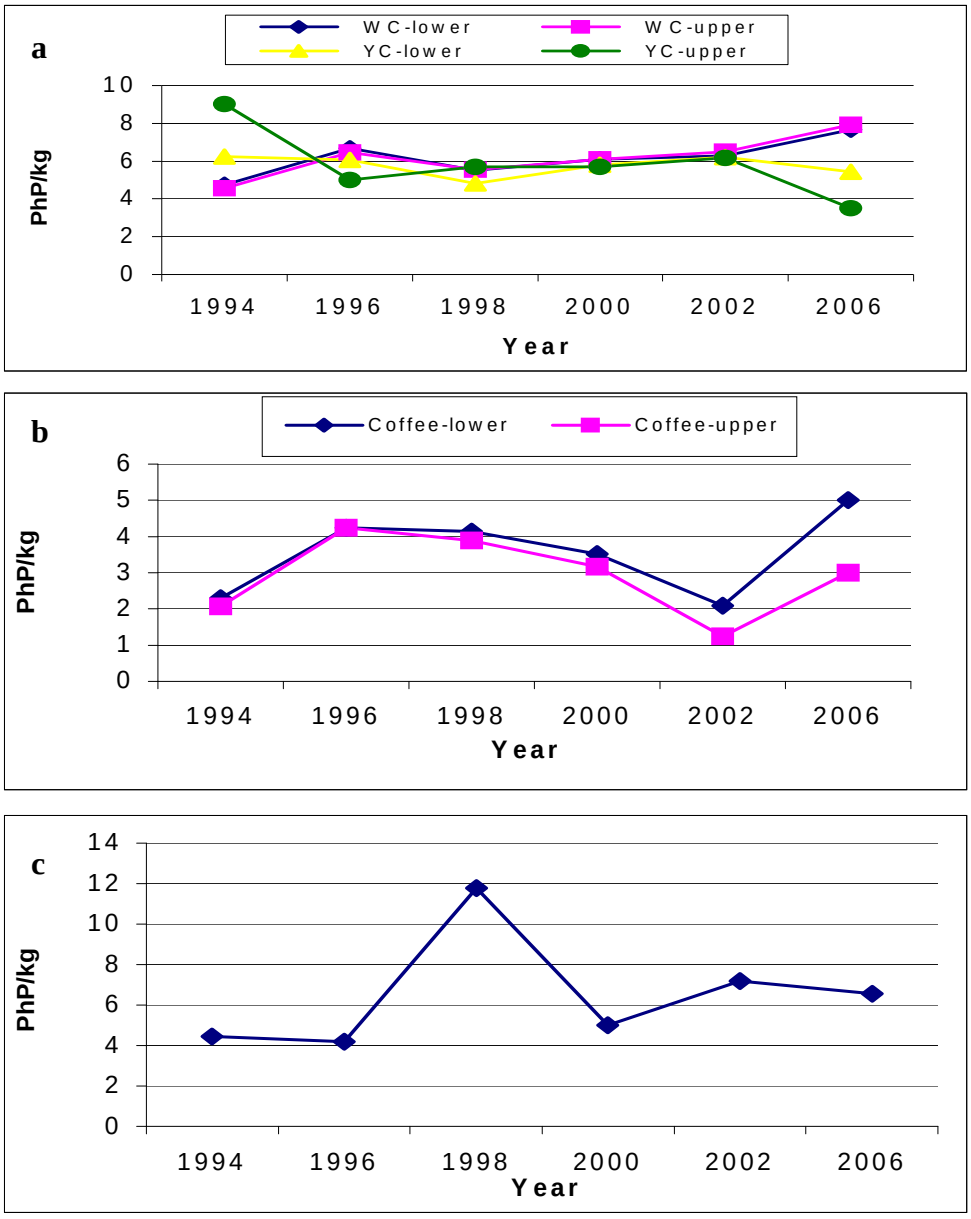


Fig. 3. Trends in farmgate prices, (PhP/kg) of a) corn b) coffee c) cabbage, by location, 1994 to 2006.

III.4. Trends In Gross Value of Production

III.4.1. Corn

Gross value of production of yellow corn was higher than that of white corn for both watersheds from 1996 to 2002 (**Fig. 4a & 4b**). However, situation changed when the price of white corn increased in 2006 while price of yellow corn largely dropped. This resulted to a higher gross value of production of white corn as compared to yellow corn

for that year. Decrease in gross value of production of yellow corn was experienced in both upper and lower watershed. On the other hand, gross value of production of white corn showed an increasing trend in both watersheds. As earlier mentioned, the increase in gross value of production of white corn was heavily due to the high price as demand increased in these later years.

III.4.2. Coffee

Unstable prices of coffee in the market discouraged coffee growers to invest in this crop. Thus, we also consistently saw a downward trend in the gross value of production for coffee in both the lower and the upper watersheds, where these figures were higher in the lower watershed (**Fig. 4c**).

III.4.3. Cabbage

Cabbage production proved to be more profitable than other crops like coffee and corn. Many farmers ventured in producing vegetables like cabbage because they are hoping to hit the "jackpot", a chance to obtain high prices for cabbage.

Cabbage's gross value of production showed an upward trend (**Fig. 4d**). It only experienced a decline during 1996 because of its low price. Price of cabbage rose during 1998 but farmers were not able to capitalize on it because of their poor harvest. They only obtained a slight increase in their gross value of production in 1998.

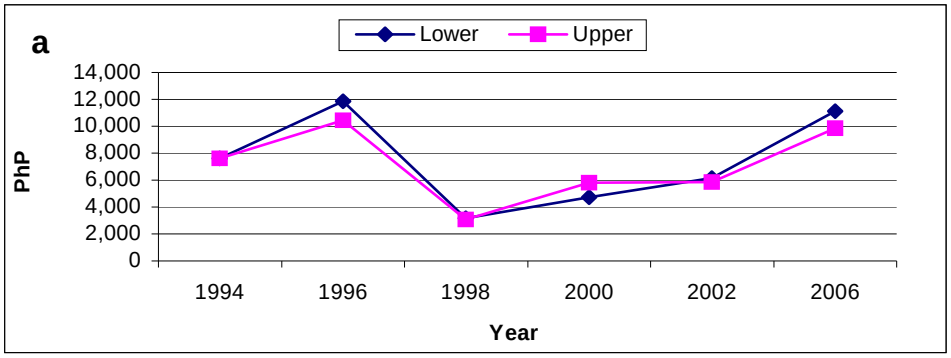
III.5. Trends in Net Value of Production

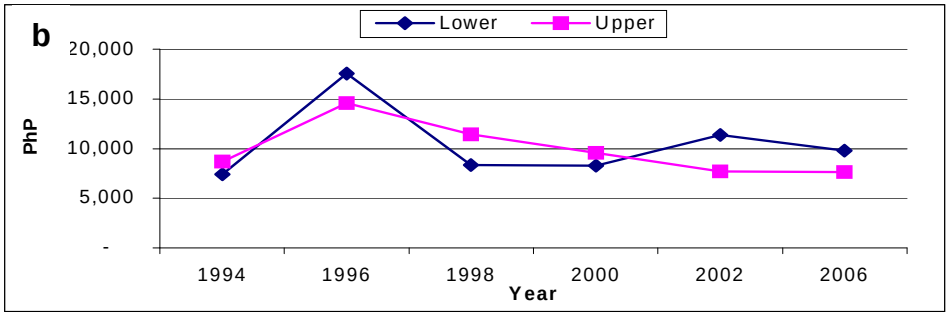
Net income from white corn dropped largely in 1998 for both watersheds (**Fig. 5a**). It was noticed that in 2006 net income from white corn has an upward trend in lower and upper watershed with farmers in upper watershed having higher net value of production.

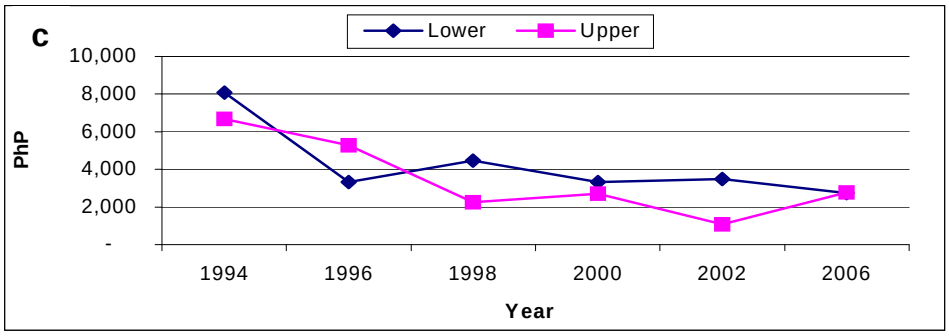
On the other hand, yellow corn growers experienced a downward trend in their net value of production (**Fig. 5b**). In lower watershed, net income from yellow corn has wide variation unlike in the upper watershed were consistent decline in its net income was observed. Net income from yellow corn also dropped significantly from 2002 while net income from white corn had a huge increase. High yield of yellow corn did not offset the low price of the crop in 2006.

Coffee growers in the lower watershed had a higher net value of production although it showed a downward trend (**Fig. 5c**). They were not really affected by drought unlike coffee growers in the upper watershed whose net value of production declined.

On the other hand, increasing net income from cabbage benefited the farmers. Their net income has consistently increased during the study duration (**Fig. 5d**).







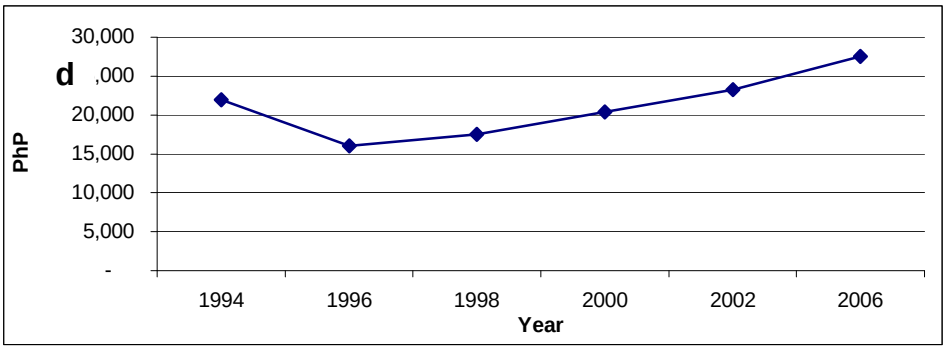


Fig. 4. Trends in gross value of production, PhP, of a) white corn b) yellow corn c) coffee d) cabbage, by location, 1994 to 2006.

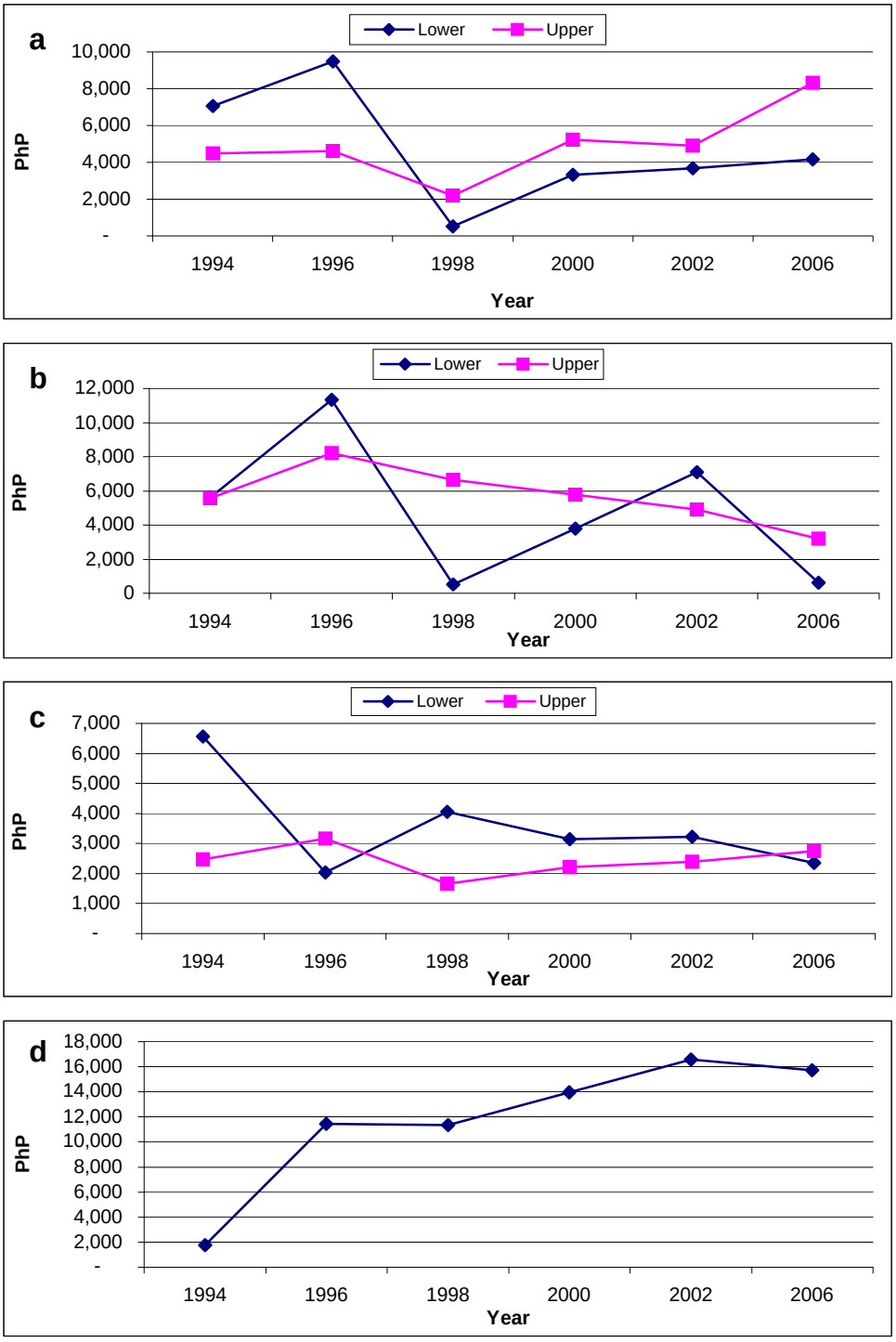


Fig. 5. Trends in net value of production, PhP, of a) white corn b) yellow corn c) coffee d) cabbage, by location, 1994 to 2006.

III.6. Trends in Cost of Production

III.6.1. Trends in input prices

Trends in retail price of inputs like seeds and fertilizers showed an increasing pattern. Our data also revealed that seed price of yellow corn was more expensive than white corn (**Table 5**). On the other hand, cabbage seeds are high-priced and had been consistently increasing.

Table 5. Trends in input price per unit (PhP) by crop and by plot, Lantapan, Bukidnon, 1994 to 2006.

	1994	1996	1998	2000	2002	2006
Corn						
White						
Seed(kg)	5.33	4.91	5.6	6	7	9.33
Fertilizer(sack)	286	360	383	370	409	588
Pesticide(li)	450	375	350	394	397	587
Yellow						
Seed(kg)	-	57	76	72.5	83	97.5
Fertilizer(sack)	216	375	375	388	391	619
Pesticide(li)	-	390	-	-	394	465
Coffee						
Seed(kg)	-	-	-	-	-	-
Fertilizer(sack)	228	400	375	-	-	-
Pesticide(li)	-	-	-	-	-	-
Cabbage						
Seed(100 grams)	950	1000	1075	-	1100	1154
Fertilizer(sack)	248	350	363	400	280	539
Pesticide(li)	294	440	502	300	420	650

There were no significant differences in the price of fertilizer per crop. However, price of fertilizer increased steeply from 2002 to 2006 for all crops. This is also the scenario for the retail prices of pesticides. Cabbage had the steepest rise in price of fertilizer and pesticide from 2002 to 2006.

III.6.2. Trends in Cost of Production of Crops

The data in Tables 6 and 7 summarize the cost of production for corn, coffee and cabbage in the lower and upper watershed, respectively.

Corn

Production cost of white corn jumped dramatically in 2006 **(Table 6)**. Cost of fertilizers contributed largely to this rapid increase in production cost. Larger costs of pesticides were also incurred although labor cost decreased by 27% from 2002 because family members did most of the tasks. For yellow corn, labor costs share in production also dropped by more than 30%. Cost share of seeds was steadily increasing for both

varieties of corn. In general, farmers still allotted the biggest portion of their investment in buying fertilizers and hiring labor.

In upper watershed, cost of corn production was a little lower than in lower watershed. Production cost share of seeds for both varieties increased steadily with yellow corn having the higher figures (**Table 7**). Increasing seed production cost share of yellow corn was due to the continuous price hike of seeds.

Coffee

Generally, farmers were experiencing low returns from coffee production. This was explained by limited capital they allotted for the crop. Farmers were afraid to invest heavily on coffee because of its unstable prices in the market. However, they maintained their farm hoping for the price of coffee to go up. Coffee growers in lower watershed invested in fertilizer to have a good harvest. However, in 2006, coffee production cost was 100% labor.

Cabbage

Most of the farmers obtained their seeds from their own farm. This resulted to a lower cost incurred for seeds. Production costs of cabbage tended to go up as indicated by the data of 2006 due to massive use of fertilizers and pesticides as farmers intensified vegetable production in the area. In 2002, use of fertilizers was reduced but pesticide usage greatly increased. Also in 2002, high price of inorganic fertilizers and declining soil fertility in the upper watershed gave way to increased use of organic fertilizer. However, growing demand for vegetables in the market because of the tendency of the people to have a healthy living persuaded the farmers to intensify vegetable production by using higher amount of fertilizers and chemicals than previous years. Pesticide cost was also high. The lowest cost in vegetable farming was incurred in 1998. They expected their crop to be destroyed by the drought during that year and farmers did not invest in cash inputs. Farmers did not hire any labor instead they poured their resources in buying fertilizers hoping to reinvigorate the vegetables even in a bad weather condition.

Noticeably, labor costs dropped considerably. There was a decline in labor cost share in 2006 that could mean a shift to labor saving technologies.

Table 6. Distribution of cost of production per hectare (in percent) in the lower watershed, by crop and by plot, Lantapan, Bukidnon, 1994-2006.

Crop		1994	1998	2002	2006
Corn	*n* =	*45*	*24*	*12*	*9*
White	Seed	1.3	4.9	4.7	7.0
	Fertilizer	43.1	42.6	35.6	56.6
	Pesticide	-	5.1	2.9	6.8
	Labor	55.6	47.4	56.7	29.7
	Total cost (PhP)	6,997	4,856	6,116	9,872
	n =	*13*	*3*	*9*	*6*
Yellow	Seed	10.3	22.4	12.8	16.5
	Fertilizer	41.8	57.9	23.6	52.4
	Pesticide	-	-	4.9	4.1
	Labor	48.0	19.8	58.7	27.1
	Total cost (PhP)	8,732	6,481	10,277	11,099
	n =	*44*	*24*	*6*	*17*
Coffee	Seed	-	-	-	0
	Fertilizer	62.0	55.4	-	0
	Pesticide	-	-	46.2	0
	Labor	38.0	44.6	53.8	100
	Total cost (PhP)	2,944	2,706	1,201	1,366

Table 7. Distribution of cost of production per hectare (in percent) in the upper watershed, by crop and by plot, Lantapan, Bukidnon, 1994-2006.

Crop		1994	1998	2002	2006
Corn	*n* =	*74*	*36*	*31*	*25*
White	Seed	1.4	3.8	6.1	7.3
	Fertilizer	53.3	35.5	41.7	41.3
	Pesticide	8.2	27.9	7.3	31.5
	Labor	37.1	32.9	44.8	19.9
	Total cost (PhP)	4,051	3,982	3,273	6,556
	n =	*19*	*3*	*3*	*3*
Yellow	Seed	6.1	19.3	10.9	25.9
	Fertilizer	81.8	44.7	41.1	50.9
	Pesticide	-	-	0.7	7.9
	Labor	12.1	36.0	47.3	15.2
	Total cost (PhP)	9,384	6,565	4,671	9,428
	n =	*25*	*5*	*11*	*10*
Cabbage	Seed	16.4	25.5	13.8	11.2
	Fertilizer	36.4	34.5	22.2	53.3
	Pesticide	11.9	14.8	26.4	20.8
	Labor	35.2	25.2	37.6	14.8
	Others	-	-	-	-
	Total cost (PhP)	5,996	9,135	19,854	18,322

III.7. Net Household Income Trends

III.7.1. Crop Level

Residents in the study site had a variety of income sources. Almost all households have income from the following sources: farm, off-farm and non-farm. In lower watershed, almost all households had a declining share of farm income in their total earnings. Percent contribution of non-farm income of households venturing in corn, coffee and sugarcane production was definitely increasing (**Table 8**). Only those households with no crop exhibited a decreasing trend in the proportion of non-farm income to total income. Generally, households investing in sugarcane obtained the highest net income in the watershed.

Table 8. Percent distribution of monthly real income of households, by crop, lower watershed, Lantapan, Bukidnon, 1998-2006.

Crop	Income source	1998	2000	2002	2006
			(%)		
Corn	*n* =	9	12	8	7
	Farm	24	15	9	3
	Off-farm	16	45	37	37
	Nonfarm	60	41	54	60
	Total	3,393	5,324	7,824	15,387
Coffee	*n* =	7	9	4	5
	Farm	15	10	32	9
	Off-farm	10	33	-	0
	Nonfarm	75	57	68	91
	Total	4,817	5,824	5,080	6,075
Sugarcane	*n* =	1	2	3	3
	Farm	-	-	26	12
	Off-farm	-	6	22	9
	Nonfarm	100	94	52	79
	Total	1,465	9,377	10,403	17,163
No crop	*n* =	5	1	9	2
	Farm	-	-	-	-
	Off-farm	5	100	32	76
	Nonfarm	95	-	68	24
	Total	4,085	5,183	8,015	11,820

In upper watershed, monthly income of households was increasing. Like in lower watershed, corn growers were experiencing a declining percent share of farm income to total household income (**Table 9**). There is a need for the family to look for other sources of income aside from farming because return from corn was not very high. Existence of two big banana plantations in the study area provided better opportunity to have an alternative job aside from farming. On the other hand, households planting vegetables showed an increasing proportion of farm income to total income of the households. In 2006, 60% of their household income came from the farm. High labor requirement of vegetable farming was one of the main factors for the increasing share of farm income. Most of the time, family members were already engaged in growing vegetables and have no time to do a non-farm work unlike when they were growing other crops like corn where they can also do non farm employment.

Table 9. Percent distribution of monthly real income of households, by crop, upper watershed, Lantapan, Bukidnon, 1998-2006.

Crop	Income source	1998	2000	2002	2006
			(%)		
Corn	*n* =	22	30	17	10
	Farm	12	14	9	6
	Off-farm	19	37	41	22
	Nonfarm	68	49	49	73
	Total	3,871	4,529	4,293	10,828
Veg	*n* =	10	2	21	15
	Farm	29	13	80	60
	Off-farm	28	-	8	12
	Nonfarm	43	87	13	29
	Total	5,695	3,536	11,241	14,127
No crop	*n* =	2	-	11	1
	Farm	-	-	-	-
	Off-farm	49	-	100	43
	Nonfarm	51	-	-	57
	Total	1,486	-	1,829	7,385

III.7.2. Household Level

In the lower watershed predominantly corn household members have increasingly sought non-farm incomes (Rola and Coxhead, 2002). As a result, in 2006, 59% of the household incomes were from non-farm sources (**Table 10**). Establishment of banana plantations in the area contributed to the increasing share of off-farm income.

The sources of income of household respondents in the upper watershed were also varied. Decreasing farm income share was also observed. Despite of increasing share of farm income in vegetable system, this could not offset the share of non-farm income in households with other crops like corn and coffee.

In both watershed locations, our data revealed that households had an increasing income trend. Generally, households in the lower watershed had higher monthly income compared to households in the upper watershed. Both locations were also exhibiting downward trend of the percent share of farm income to total household income. Our data (see also Rola et al. 2007) also suggest that lower return from farming influenced household members to shift to other jobs which gave a higher income. This is the reason why more of the household members engaged in non-farm jobs.

Table 10. Percent distribution of monthly real income of households lower and upper watershed, Lantapan, Bukidnon, 1998-2006.

Location	Income source	1998	2000	2002	2006
			(%)		
Lower watershed	*n* =	*39*	*38*	*41*	*33*
	Farm	18	11	26	7
	Off-farm	16	38	27	34
	Nonfarm	66	51	47	59
	Total	4, 017	5, 853	10, 453	11, 547
Upper watershed	*n* =	*54*	*46*	*68*	*47*
	Farm	30	17	46	12
	Offfarm	27	39	21	23
	Nonfarm	43	44	32	65
	Total	4, 547	4, 060	7, 749	9, 233

IV. SUMMARY AND CONCLUSIONS

The results of this long term study gave us a glimpse of the resilience of upland households to external shocks. The most significant finding seems to be the continuous shift in land use, away from cereal crops and into commercial crops like bananas (even by small farmers), sugarcane, vegetables and some rehabilitation of coffee plants. In the previous (Coxhead et al. 2001, Coxhead et al. 2002, for instance) studies, it was found that land use shift was triggered by changes in relative prices. While banana price is not available at the moment, key informants say that banana is profitable even for small farmers producing for the local market. There are now 4 banana plantations in 2006 (and one more to be established in 2007) in the study area from two plantations in 2002, which production caters to the world market. Sugarcane area is increasing; and also vegetables in the upper watershed. Coffee price is on the rise from 2002 to 2006, which also explains the observed increase in coffee area that is being rehabilitated.

An interesting twist in the story though is the increase in the price of white corn relative to yellow corn in the area. White corn is for home consumption, and most farmers became commercial crops growers. Now the demand for white corn for food has increased, and farmers in the upper watershed growing this crop are observed to have higher net incomes from 2000. In addition, corn in the upper watershed has higher yields than in the lower watershed because of the fertilizer residues in the soil after the vegetable cropping in the vegetable-corn crop rotation.

Use of chemicals like fertilizers and pesticides especially in vegetable production intensified as expected. These inputs have the biggest share in the production cost of crops. In general, agricultural externalities due to the chemicals occur and agricultural policy should focus on the measures to mitigate these externalities' impacts on health, water, soil and air.

Non-farm employment is still the major source of income for most of the farmers. Only farmers with vegetable production have predominant farm income sources. Due to this, it is expected that most of the members of these households will be tied in growing

and managing their farm, as vegetable production is labor and management intensive. But farmers who now grow sugarcane, bananas and coffee can go into non farm employment. The semi-perennial nature of the commercial crops now grown can minimize the soil erosion and degradation. But again bananas is a heavy user of fungicides and as earlier mentioned could be a threat to the general well being of the communities' population.

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