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The Expansion of Eucalyptus Farm Forest and Its Socioeconomic Background: A Case Study of Two Villages in Khon Kaen Province, Northeast Thailand

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Abstract

Recently, eucalyptus farm forest has rapidly expanded in Thailand, especially in the eastern and northeastern regions. Based on a field survey in two neighboring villages in Khon Kaen province, northeast Thailand, this research examines how recent economic changes have affected the expansion of eucalyptus farm forest, and how differences in the villages arose during the expansion process. Two kinds of analysis: static statistical analysis of the households and historical dynamics of the villages since the 1980s, were conducted. First, it was found that there were three stages of development in these villages: the factor substitution process for land, the factor substitution process for labor, and the process after the economic crisis. Second, differences in planting behavior arose as differences of response to the second stage of development. Both the history of each village and socioeconomic attributes of each household affected the response. This indicates that the villagers' eucalyptus planting was one economic-rational response to the recent changes in the rural economic environments caused by rapid economic growth. Finally, it was also found that recent land transactions, especially after the economic crisis, tend to differentiate the management scale of eucalyptus farm forest. Farm forest management is, thus, entering into another stage.

I Context

Tree plantation areas in Thailand, including farm forest, have rapidly expanded recently.[1)] The expansion of eucalyptus farm forest in the east and northeast regions is one current and drastic example. Sunthornhao [1999] estimated that there was approximately 2.7 million *rai* (1 *rai* = 0.16 ha) of private eucalyptus plantation in Thailand in 1997, of which the east and northeast regions accounted for 29% and 47% of the total planted area, respectively. Nagata and Kono [1996] estimated that approximately 550,000 *rai* of private eucalyptus plantation, of which farm forest is considered the largest part, was established between 1991 and 1996 in the northeast. This figure: 110,000 *rai* per year, is more than the annual forest depletion in this

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1) Farm forest here is defined as a small-scale tree plantation in farmland owned and managed by villagers. I use this word to contrast large-scale plantations by enterprises.

region which occurred during 1991 and 1993. This indicates that eucalyptus had already become one of the important "cash crops" despite the negative image of the anti-eucalyptus movements in this area.[2)]

Eucalyptus (*Eucalyptus camaldulensis*) is mainly used for pulp, construction poles, furniture and wood chips in Thailand. It has been in the spotlight since the late 1980s, in accordance with the price hike of pulp products in both domestic and international markets. For structural adjustment in the agricultural sector, the government has also promoted planting fast-growing tree species such as eucalyptus to replace various agricultural crops (such as cassava), which have been facing marketing problems. It has also tried to encourage villagers' participation in reforestation activities.[3)] On the other hand, some point out negative impacts, such as competition with other crops for water and nutrients.

Past arguments related to eucalyptus planting in Thailand have been mainly concerned with whether the adoption of eucalyptus is desirable or not. Tasaka [1992] determined that anti-eucalyptus movements during the 1980s were the cause preventing "forest enclosure" by the government and private sector after the policy change to promote tree planting by the private sector. Carrere and Lohmann [1996] regarded that the spread of contract tree farming (CTF) after opposition and clashes by angry villagers, was a "second-choice strategy" for social and economic control by "the industry and its official allies" to prevent the outbreak of organized resistance.[4)]

These studies analyze the anti-eucalyptus movement from the perspective of political economy (or political ecology). However, they tend to over-emphasize policy and global business rather than considering the villagers' choices and decision-making process for accepting eucalyptus planting.

From the economic point of view, some researchers examined the economic efficiency and fairness of the planting. Based on a field survey during the 1980s in the eastern region, Tongpan *et al.* [1990] pointed out that eucalytpus had a longer period for production and required a larger initial investment than other field crops. This made it difficult for the

2) There have been decades of disputes on eucalyptus plantations since the government launch to lease "degraded forest reserves," which the villagers had partly occupied for years, to the private sector for planting this species. Tensions arose between government and villagers, and this led to anti-eucalyptus movements. In addition, a pulp mill in the northeast, which uses this tree as raw material, has been accused of causing major water pollution problems in the Chi river system. These movements and accusations have been highly publicized and contributed toward a negative image on the species.

3) For instance, Restructuring Agricultural Production System Project (*khrongkan prap khrongsang lae rabop kanphalit kankaset*) aimed to replace cassava by fast-growing trees. The Reforestation and Extension Project in the Northeast of Thailand (*khrongkan songsoem pluk pa phak tawanok chiangnua*) promoted reforestation by villagers. In order to focus on the villagers' adaptation process, I have not discussed the policy interventions in this paper in detail, though they did contribute to the expansion of farm forest.

4) Contract tree farming (CTF), is a kind of contract between farmers and entrepreneurs. Farmers are responsible for tree growing, while entrepreneurs provide credit and input materials such as seedlings and fertilizer. A minimum price for the products is guaranteed.

peasants to participate. Besides, there were economies of scale for production. Small-scale plantation was much less profitable than large-scale monoculture plantation. This research suggests that a commercial-oriented reforestation policy during the 1980s did not solve "the vicious circle" of deforestation and poverty. However, static analysis, the analysis of this research, did not consider rapid changes in the rural economic environment from the late 1980s to early 1990s. Differences in study area also limit the application of the concluding remarks. Currently there are a large number of small-scale eucalyptus planters in the northeast region.

Some recent studies have focused on the expansion process of the eucalyptus farm forest itself. Makarabhirom [1998] examined the development of the CTF system and its relationship to policy change, business sector's strategy and land use change by farmers. Ubukata *et al.* [1998] compared the profitability of eucalyptus farm forest with that of cassava cultivation from existing data in the northeast region. They pointed out that eucalyptus farm forest provided labor savings for farmers, and the decreasing trend in the cassava farm gate price, wage increases from the mid-1980s to early 1990s, and governmental support for seedling distribution, all improved the relative profitability of eucalyptus planting.

These studies considered the change of profitability and the farmers' response in the analysis as a factor for expansion. However, distribution of farm forest is uneven among the villages even though they have the same conditions of location. Profitability does not fully account for these differences. Furthermore, how changes in the rural economic environment, including factor prices and job opportunities, affected villagers' socioeconomic status and led to eucalyptus planting (or did not lead to planting) is still unclear because of the lack of field surveys.

This question is, I believe, quite important because Thailand has experienced rapid economic growth during the late 1980s–early 1990s, and a sudden recession after the economic crisis in 1997. Such economic changes have affected factor prices and job opportunities, hence the villagers' behavior both directly and indirectly.

Further, this also provides an example for examining the possibilities and constraints of an approach to current forestry extensions in tropical areas: an approach encouraging tree planting to provide forest products to substitute those from diminishing natural forest. No research, however, is currently being conducted with such a point of view in Thailand. Based on the field survey conducted in two villages in Khon Kaen province, where land use change revealed sharp contrasts, this research first analyzes how the farm forest expanded in the area, and how differences arose between the two villages. This can highlight some patterns of development, and villagers' socioeconomic conditions which influenced them to plant commercial trees.

On the other hand, some argue that the eucalyptus expansion is now already over, and is entering a decreasing phase.[5] This may include some constraints for the farmers' application to this tree crop. Some recent trends, especially post-crisis trends concerning eucalyptus farm forest in the villages, are also described here, in order to discuss the constraints on commercial tree planting on small farms.

5) Comments by attendants from private companies in a seminar held on 23–24 Dec. 1999 at Faculty of Forestry, Kasetsart Univ.

II Methodology

The field survey was conducted in two villages: P village and G village, Phrayun district, Khon Kaen province, during January 1999 and January 2000.[6] Many villagers in P village plant eucalyptus on their farmland, while few in G village plant it. Systematic interviews on socioeconomic status (e.g. landholdings, land use, occupations, assets and so on) and its change were first conducted in each household (HH).[7] One hundred twenty-two households of a total of 127 households in P village, and all 130 households in G village, were surveyed. This was conducted in January and February/1999 in P village, and in July/1999 in G village. To avoid the seasonal variations, I tried to obtain not only current status but previous status by using life history surveys. For example, the "usual" status of the household members was surveyed for the employment survey. Thus, both on-farm and off-farm occupations were considered for the same individual.

After systematic interviews, in-depth surveys including free interviews and field observations were conducted to obtain qualitative and geographic data.

Two kinds of analysis: static statistical analysis of the households and historical dynamics of the villages, were conducted. First, the socioeconomic factors of each household affecting eucalyptus planting were analyzed by logistic regression analysis. Logistic regression is a regression model applied when the dependent variable takes binary data (= 0, 1). The following dependent and independent variables are employed for the analysis. Independent variables are related to family size and cycle, resource endowments, occupation structure, assets, farming methods, and structural difference of the villages.[8]

Dependent variable: Possession of eucalyptus farm forest and fruits gardens (owner = 1, non-owner = 0)

Independent variables: "Total HH members," "Land-labor ratio,[9]" "Non-farm worker's share,[10]" "Number of cars," and "Paddy dummy[11] (direct sowing = 1, transplanting = 0)" and "Village dummy (P village = 1, G village = 0)."

Second, based on the field survey and aerial photographs (1967, 1983, and 1996), the historical changes of each village in terms of agriculture, employment, and land use, were compared. Where some variables were hard to obtain, data from a KCC2K village database

6) The "village" here represents "*muban*," the smallest unit of local administration in Thailand.
7) The "household (HH)" here is defined as a production unit. Where two or more households share all their plots (not a part of the plots) and cultivate together, I considered it as one "household (HH)." There are 20 such cases in P village, while 6 cases were found in G village.
8) The estimation was done by SPSS.
9) (land owned – fallow + land borrowed – land rent out)/HH members mainly engaged in farming.
10) HH members mainly engaged in non-farm occupations/(total HH members – children and aged who have no occupation).
11) A dummy variable for rice growing technique.

was used for the analysis.[12)]

III The Study Area

P village and G village are located 35 km southeast of Khon Kaen city (Fig. 1). P village lies along the main road to Chaiyaphum. Access from Khon Kaen city is as easy as getting on the

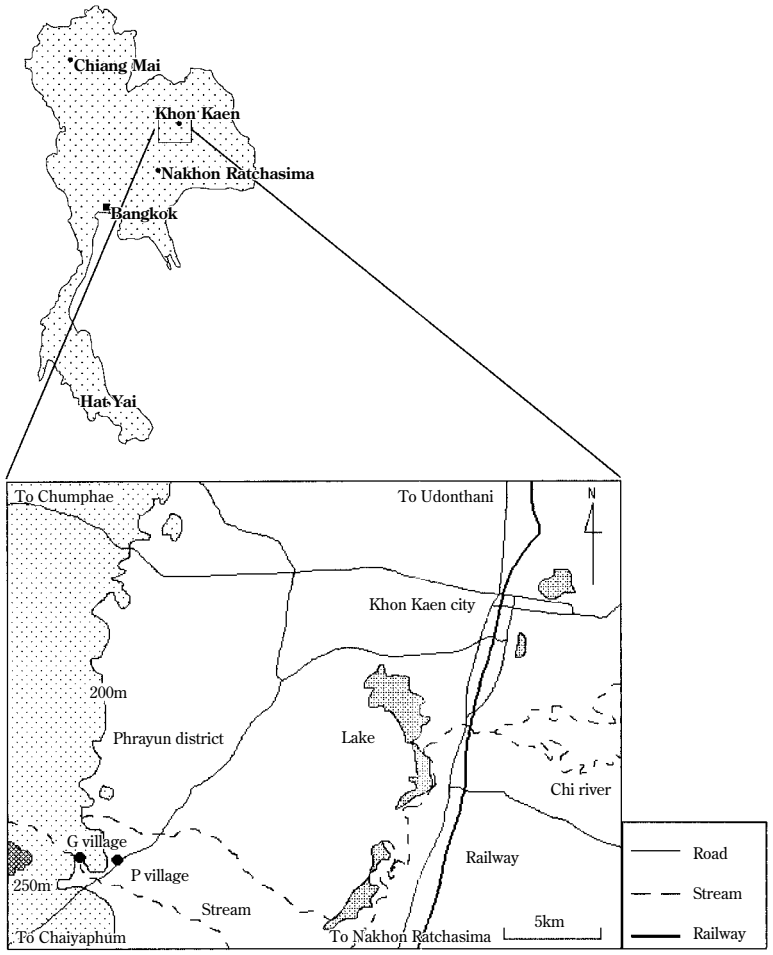

Fig. 1 The Location of the Surveyed Villages

12) KCC2K is a village database that covers whole villages (*muban*), except for the municipality (*thessaban*) and sanitary districts (*sukhaphiban*) in Thailand. The data covers various kinds of information such as population and facilities. A survey has been conducted every second year since 1986 by the Community Development Department (CDD) [Nagata 1997]. Here the wage per day in Fig. 4, the total number of households (Total HH), number of households that raise buffaloes and cattle (Raising buffaloes and cattle), and number of households cultivating cassava (cassava) in Figs. 5 and 6 were used for the analysis.

local bus which passes the main road. From there, entering the pavement byway from the main road and heading just west 2 km, G village is also easily accessible. This proximity to the city enables villagers to commute for work and study.

Thirty km north of Khon Kaen city there is a pulp mill. This mill, the only mill in the northeast region, has a great influence on the eucalyptus market in this area. The another noticeable market for eucalyptus is construction demands in Khon Kaen city. There is also a collecting center for cassava 40 km south of the city, and a sugar mill located 40 km west of the city.

Due to unstable rainfall, infertile sandy soil, and a low rate of water application, northeast Thailand has the lowest agricultural productivity in the country, although the agricultural labor force is the largest. Except for a mountainous area that lies in the western and northeastern part of the region and along the Cambodian border, hills and plateaus with gentle slopes dominate the topography of the region. Land use in the plateau mainly consists of: 1) a paddy-dominated area in the flat lowlands along the Chi and Mun rivers; 2) an area with a mosaic of paddy fields in the valleys and field crops in the uplands; and 3) field crop-dominated areas around the mountains and peripheries of the region [Somkiat and Kono 1996; Kono *et al.* 1994]. The study area can be classified as 2): rainfed paddy fields in the lowlands (glutinous rice is mainly cultivated for home consumption), and commercial field crops (cassava and sugarcane), eucalyptus, fruits and mulberry gardens in the uplands located southeast of P

Table 1 The Land Use Pattern in Surveyed Households

Item	P Village			G Village		
	Area (*rai*)	HH Owned (n=122)	Average Area per HH owned (*rai*)	Area (*rai*)	HH Owned (n=130)	Average Area per HH Owned (*rai*)
Paddy field	1,031.8	70	14.7	1,348.0	106	12.7
Field						
Cassava	13.0	1	13.0	402.0	55	7.3
Sugar cane	0.0	0		229.0	32	7.2
Eucalyptus	401.5	35	11.5	38.0	7	5.4
Fruits, vegetables, and mulberry	10.0	3	3.3	30.0	12	2.5
Fallow	171.5	11	15.6	182.0	28	6.5
Land rent out	80.0	6	13.3	241.0	12	20.1
Total land owned	1,707.8	79	21.6	2,470.0	119	20.8
Land borrowed	193.0	15	12.9	141.0	12	11.8
Leasing inside villagers	25.0	3 cases		102.0	7 cases	
Total landholdings	1,820.8	85	21.4	2,370.0	123	19.3

Notes: 1 *rai* = 0.16 ha. In P village, 70 households are owner farmers, 6 are tenants, 9 are tenant-cum-owner farmers, and 37 are landless, while 112, 6, 7, and 5 households in G village, respectively. The landless households in P village are larger in number. Most of them cultivate with their parents or relatives.
Total landholdings = Total land owned + Land borrowed – Land rent out.

village, northwest of G village, and between the P and G villages. In addition, saline soil is scattered into the paddy fields in this area. The land seriously affected has not been cultivated for over 30 years.

Table 1 shows the current land use of the villages. There is a remarkable difference between field crops and eucalyptus between the P and G villages, though the natural conditions of location are similar. In general, the farmers who plant eucalyptus consist of three groups: those who participate in the Restructuring Agricultural Production System Project, those who contract CTF with private companies, and those who planted spontaneously. Here, no one joined the project, and only one household contracted CTF. Most of the planters planted eucalyptus spontaneously.[13)]

Tables 2 and 3 show P and G villagers' employment status, respectively. Peddlers and shopkeepers in P village, miscellaneous jobs and factory work in G village are outstanding. The peddling business in P village has been one of the major non-farm occupations in the village since a villager started it in the 1960s. In the past, villagers rode motorcycles and sold small commodities such as stickers and alarm watches. Now they use pick-up trucks to sell second-hand clothes, aluminum cupboards, cloth for sunshades, and so on. Most of them are small-scale peddlers that use family labor, while some wealthy villagers have several trucks and

Table 2 Villagers' Occupation in P Village

	Occupation	Around the Village	Khon Kaen	Bangkok	Others	Total
	Farming	274				274
Non-farm	Peddler & shopkeeper	143				143
	Factory worker		1			1
	Company employee & engaged in services	2	1			3
	Driver	1				1
	Artisan & repairer	9	1	2		12
	Public officer & teacher	2	1	2		5
	Nurse	1	1			2
	Maid			1		1
	Poultry breeder	2			3	5
	Miscellaneous	56	7	6		69
	Military			1		1
	Working abroad				1	1
	Non-farm in total	216	12	12	4	244

Notes: Occupations of 369 individuals. Of 584 surveyed villagers 215 who have no occupation are excluded (102 students and 113 others). Village head is not included for occupations. "Miscellaneous" includes farming employment and temporary unstable jobs in various times and places. Poultry breeder includes non-farm occupation in the analysis.

13) Some planters in P village, however, received free seedlings from The Reforestation and Extension Project in the Northeast of Thailand.

Table 3　Villagers' Occupation in G Village

Occupation		Around the Village	Khon Kaen	Bangkok	Others	Total
Farming		381				381
Non-farm	Peddler & shopkeeper	13				13
	Factory worker		50	32	1	83
	Company employee & engaged in services	6	4	8		18
	Driver	5				5
	Artisan & repairer	1		1		2
	Public officer & teacher	5	2	1		8
	Nurse			2		2
	Miscellaneous	263	3	1		267
	Unknown				2	2
	Working abroad				2	2
Non-farm in total		293	59	45	5	402

Note: Occupations of 445 individuals.　Of 600 surveyed villagers 155 who have no occupation are excluded (97 students and 58 others).

employ their neighbors.　After the economic crisis, some claimed the margins had dropped, and they started to deal in new commodities such as confectionery.

Fig. 2 shows the change of land use based on aerial photographs taken in 1967, 1983 and 1996 around the villages.　Fig. 3 shows a transect of land use across P and G villages. According to the villagers, the uplands between P and G village, were covered with forest until the 1950s.　In 1954, the villagers started opening up the forest and planting field crops such as cotton and sesame.　In the mid-1960s, kenaf planting started.　As the demand grew, the remaining forest was gradually replaced by this fiber crop.　Then in the 1970s kenaf was replaced by cassava, and the upland forest was almost cleared.　In the 1990s, eucalyptus planting and sugarcane cultivation had expanded on the east and west sides of the upland, respectively.　Since the 1960s, salinization in the paddy field also occurred.　The eastern rim of the uplands received the most serious damage.

IV　The Planter's Characteristics

Table 4 is a comparison in socioeconomic status between owners and non-owners.[14)]　This shows that the owner group tends to have more land with less agricultural labor, more assets (i.e. cars) and non-farm employment.　As eucalyptus is usually planted in upland fields, it is more appropriate to compare the households with upland fields, showed in parentheses.　The differences in landholdings narrowed in number, while there were larger differences in ownership of cars and direct-seeded paddy.

14)　In most cases owners are consistent with planters, though some planters (seven households) sold their farm forest and are not the current owners.

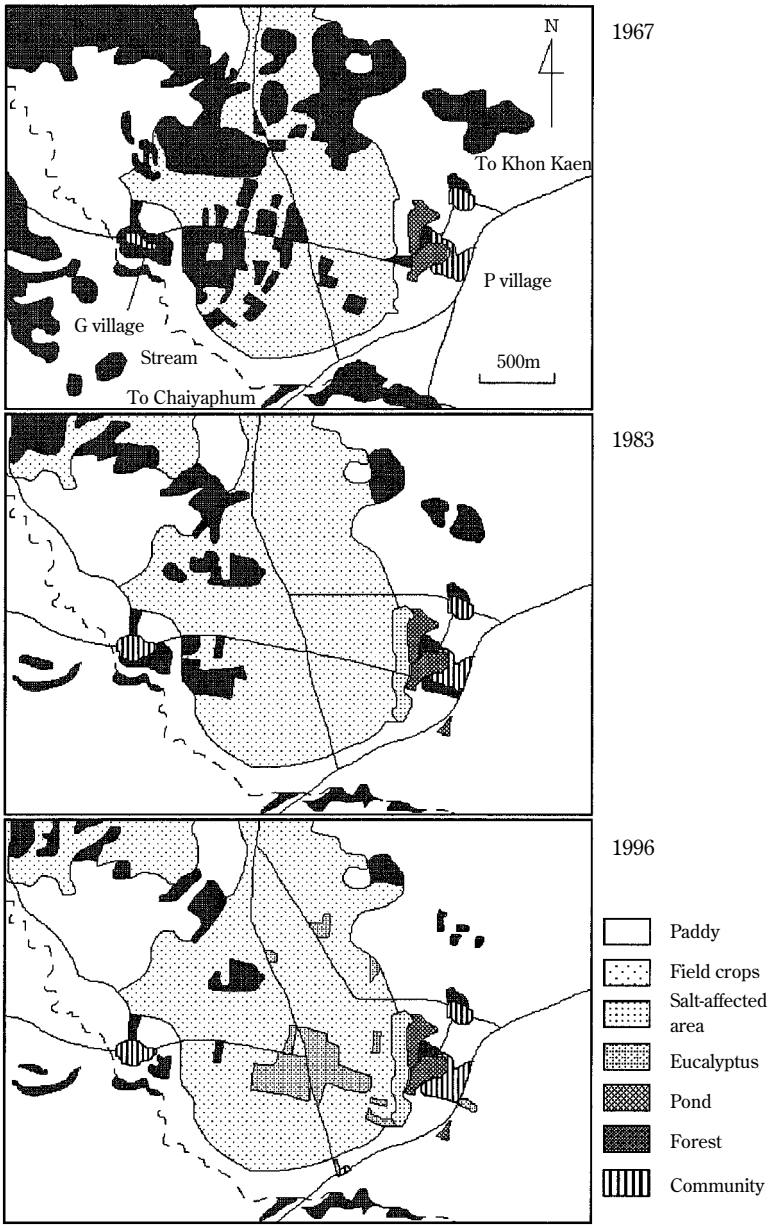

Fig. 2 The Change of Land Use around the Villages
Note: Based on aerial photographs and interviews.

Table 5 shows the results of logistic regression analysis. Only households with upland fields are used in the analysis. Due to the multicollinearity between "Paddy dummy," and "Village dummy," I estimated two types of regression models. Among coefficients in model 1, "Land-labor ratio," "Number of cars," and "Paddy dummy" are statistically significant. All these

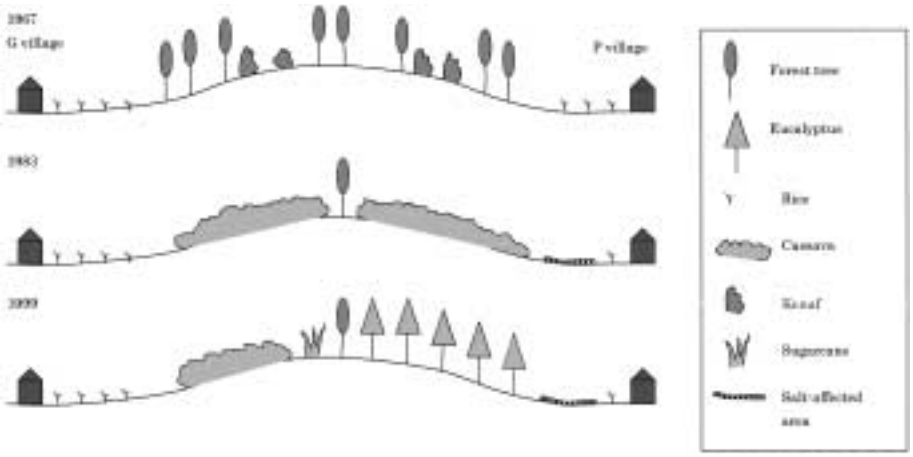

Fig. 3　Transect of Land Use across P and G Villages
Note: Based on aerial photographs, interviews and observations.

Table 4　Socioeconomic Characteristics of Owners and Non-owners

Item	Owners	Non-owners (those owning upland fields)
Number of HH	45	149(63)
Age of HH head	53.4	55.5(52.5)
Total HH members	5.4	5.4(4.7)
HH members mainly engaged in farming	1.8	2.6(2.7)
HH members mainly engaged in non-farm occupation	1.7	1.2(0.9)
Land owned (*rai*)	28.0	19.5(23.4)
Landholdings (*rai*)	27.8	18.9(23.1)
Land cultivated (*rai*)	25.3	17.2(21.9)
Number of cars owned	1.2	0.3(0.2)
Application of direct-sowing in paddy(%)	76	27(2)

Notes: The data shows the average of each category in both P and G villages.
Parentheses in Non-owner show for HH owning upland fields.
Landholdings = Land owned + Land borrowed − land rent out.
Land cultivated = Landholdings − fallow.

coefficients show positive signs.

In model 2, “Number of cars,” “Non-farm worker’s share,” and “Village dummy” are statistically significant.　“Number of cars” and “Village dummy” show positive signs, while the “Non-farm worker’s share” is negative.　As for the “Non-farm worker’s share,” a calculation from Table 4 shows 31.5% for owner, and 19.1% for non-owner with upland fields.[15)]　This trend

15)　100 · HH members mainly engaged in non-farm occupations/(HH members mainly engaged in farming + HH members mainly engaged in non-farm occupations).

Table 5 The Result of Logistic Regression Analysis

Variables	Model 1	Model 2
Land-labor ratio	0.109(2.72)*	0.101(2.42)
Number of cars	1.615(6.29)**	1.640(9.29)***
Total HH members	0.219(0.79)	0.214(0.87)
Non-farm worker's share	−2.702(2.19)	−3.355(3.28)*
Village dummy		5.030(16.57)***
Paddy dummy	4.948(17.28)***	
Constant	−4.038(5.90)**	−3.786(5.79)**
HH included in the model	93	97
HH excluded in the model	14	10
Nagelkerke R^2	0.708	0.708
Count R^2	0.903	0.897
−2 log likelihood	54.4	56.4

Note: Wald statistic in Parentheses. *, **, and *** represent significance at .1, .05, and .01 level. Count R^2 is defined as the proportion of correct prediction of $y\hat{}_i$ (= number of correct predictions/total number of observations) [Maddala 1988].

is opposite to that of logistic regression (model 2), while other variables show the same trend. This contradiction, which is discussed later, implies a variety of reasons not captured in this analysis for villager choice of occupations.

In short, the following results can be summarized from the analysis.

1) The owner tends to hold more land with less family labor in farming than the non-owner. The difference is slight, however, in land-labor ratio when compared to non-owners with upland fields.
2) The owner tends to have more assets, and to engage in profitable and stable non-farm occupations that use vehicles (i.e. peddler, driver, middle man, etc.). In terms of non-farm occupation, however, there are a variety of reasons for application, causing mixed signs in the analysis.
3) The owner tends to apply direct-sowing techniques in rice cultivation.
4) There are structural differences between the P and G villages, which bear the differences in eucalyptus planting.

These results indicate the substantial nature of tree growing. It requires a smaller labor force, with a larger investment and longer gestation period than for cash crops. Therefore, it is easier for land and capital-abundant (and labor-constrained) households. Similar results are presented by Tongpan *et al.* [1990] in the east region of Thailand and Saxena [1994] in India.

However, in the regression analysis the coefficient of "Land-labor Ratio" shows a lower level of significance than with other variables and, in model 2 it is not significant. Two explanations are possible for this. First, field crop cultivation in this area depends more upon

hired labor than rice cultivation. Second, the household labor supply of the field crop cultivation is so flexible that the survey might not follow the difference.[16] In any case, the analysis shows that the differences in assets are more significant than that of land-labor ratio.

As for 2), my analysis shows mixed signs for non-farm occupations: a positive correlation in Table 4, with negative signs in the regression analysis (model 2) shown in Table 5. Table 6 shows distributions of "Non-farm workers' share" for two groups: owner and non-owner with upland fields. Both groups have the largest numbers in the 0–20% layer, while the former tends to have higher values otherwise. One possible explanation for the mixed signs may lie in this distribution: a two-peak distribution for the owner group. There are 13 owners in the 0–20% layer, and their reasons for application are somewhat diversified. For example, 2 faced bad soil conditions, including saline soil. Two stated governmental promotion (with one having worked in the nursery unit of the project). One followed the advice of his relatives. This implies that there are a variety of reasons for application, though there is a tendency for owners to engage more in stable non-farm occupations. Nagata and Kono [1996] also concluded that eucalyptus plantation areas covered in a questionnaire survey did not correlate with "the number of person who work outside the sub-district (*tambon*)" using the KCC2K database.

Second, this variable may not fully account for qualitative differences on occupation, as the same quantity in data sometimes reflects different situations in the households. For example, a household that is "forced" to work in the non-agricultural sector compared to one which seeks additional income is different in background. In this study, "Number of cars" can partly reflect such differences as well as differences in assets.[17] Many villagers, especially in P village, engage in profitable and relatively stable occupations that use vehicles.

As for 3), the direct-sowing technique is currently spreading all over the region. Somkiat and Kono [1996] report its application as an adoption to the labor shortage caused by the efflux of labor into the non-agricultural sector. NERAEO [1995] also refers to it as a response to wage increases. In the study area, the spread of this technique in paddy field is overlapping

Table 6 The Distributions of "Non-farm Workers' Share"

Non-farm Workers' Share (%)	Owners	Non-owners
0–20	13	31
20–40	5	14
40–60	6	13
60–80	7	4
80–100	12	1
Total	43	63

16) For instance, based on a field survey in a village in Khon Kaen province, Fukui[1993] pointed out that labor allocation for upland farming is "scheduled to avoid the peaks of rice growing." This implies the villagers' secondary consideration on labor allocation for upland farming, which results in a "flexible" labor supply for it.

17) For example, number of cars are strongly correlated with number of HH members engaged in peddling or shopkeeper business (Pearson correlation = 0.593 among HH with upland fields).

with the adaptation of eucalyptus in the upland.

Finally, 4) suggests that structural differences among the villages include differences in the development path of each village. This indicates that dynamics of development paths of the villages: factors which are difficult to pick up in the static analysis of each household, have affected the villagers' decision-making process. A historical dynamics approach was used to further analyze the development path of each village.

V The Differences in Development Path between Two Villages and Eucalyptus Planting

Fig. 4 shows the wages in the surveyed villages and price trends of eucalyptus and its competitive cash crop, namely cassava during 1985–98. Figs. 5 and 6 show various aspects of historical change in the P and G villages over the past 10 years. The following results can be drawn from these figures.

In Fig. 4, a stable trend of eucalyptus mill-gate price with an unstable trend for the cassava farm-gate price can be observed. Low cassava prices during 1989 and 1994 may have affected eucalyptus planting, though this does not explain the differences between the two villages. After 1996, the eucalyptus mill-gate price (real rate) tended to decrease because the paper mill held it unchanged, reflecting its financial condition after the economic crisis.[18] Wage also

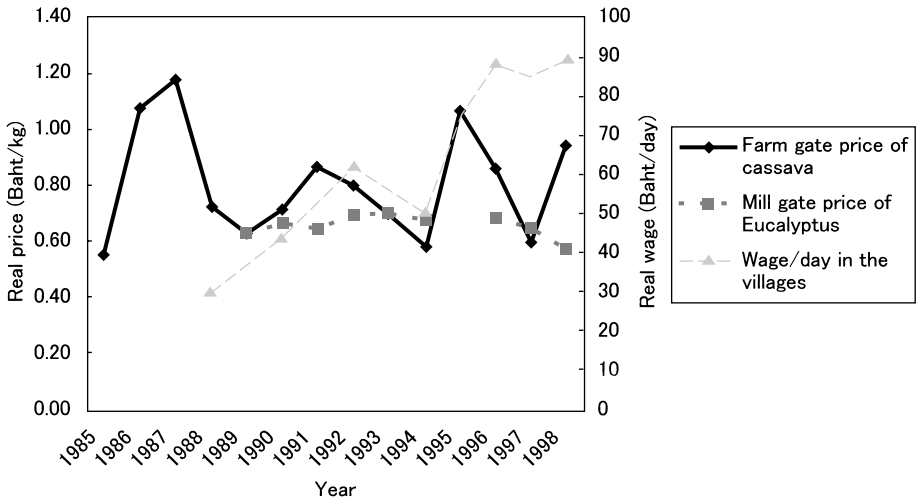

Fig. 4 The Price Trend of Eucalyptus and Cassava and Wage in the Villages

Notes: Revised Ubukata *et al.* [1998: Fig. 1]. 1 Baht=0.04USD in 1996. Standardized by WPI (Base year: 1994). Wage is based on field surveys and KCC2K database. The same wage trend in two villages except 1998. For 1998, I applied that of G village.

Additional Sources: OAE [1991; 1996; 1999], Songanok [1994], DBE [1997], ERD [n.d.] and interviews in Khon Kaen in 1996, 1997 and 1998.

18) Further, since 1997 the paper mill started to pay middle men by check rather than directly. This caused a further deterioration in terms of price.

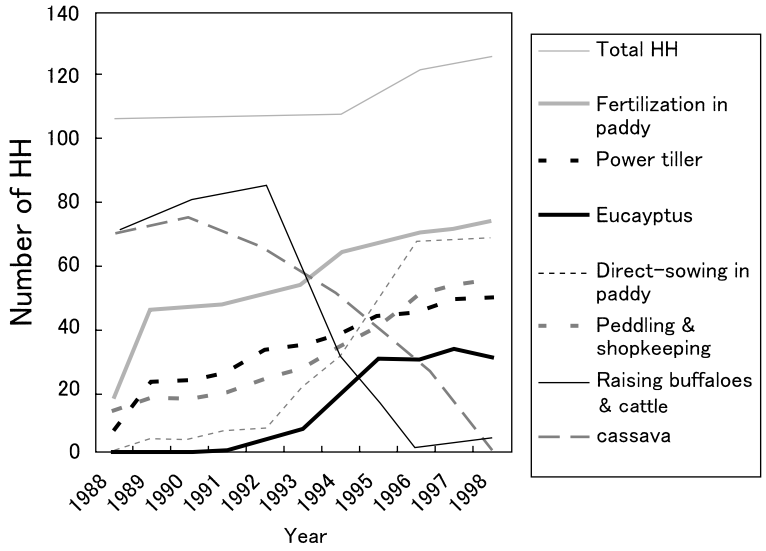

Fig. 5　Change of Socioeconomic Indicators in P Village

Note:　Based on field surveys except for the previous data of Total HH, Raising buffaloes & cattle, and cassava, which are from KCC2K database. As KCC2K database is available every two years, I applied the mean of the previous and following year for intermediate years.

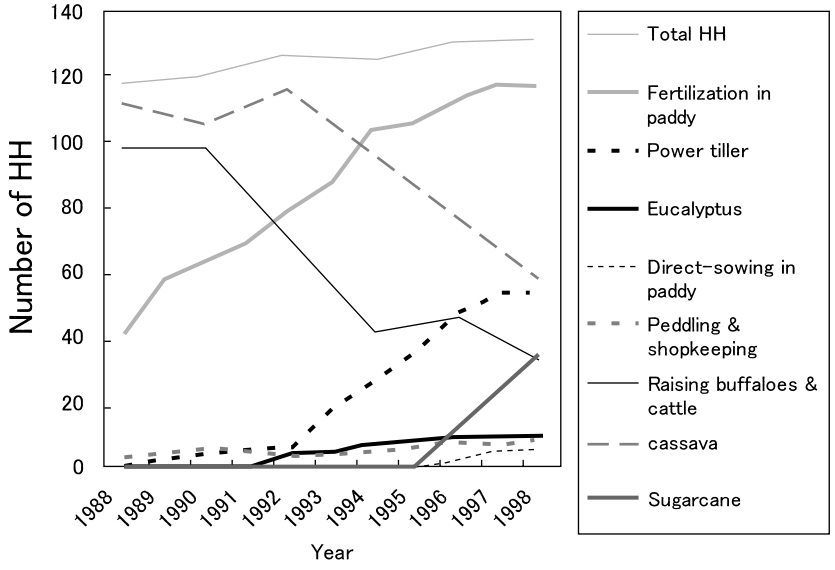

Fig. 6　Change of Socioeconomic Indicators in G Village

Note: See Fig. 5 for data source.

shows a drastic increase in both villages: 4–5 fold in the nominal rate, and 2–3 fold in the real rate.

In Fig. 5 (changes in P village), "the Number of HH" shows a gradual increase. A sudden increase during 1994 and 1996 arose due to the formation of a small community, caused by an influx from other areas. Fertilization in paddy fields and possession of power tillers show an increase during the 1980s and 1990s (after the introduction of HYV: namely, RD6). Currently, almost all households with crop cultivation use fertilizer. Possession of eucalyptus farm forest, direct-seeded paddy, and peddling business show a rapid increase from 1992–96. Possession of buffaloes and cattle shows a rapid fall since 1992. In P village, this tradition has almost vanished. Finally, cassava cultivation shows a similar fall since 1994, while no sugarcane production exists.

In Fig. 6 (changes in G village), "the Number of HH" shows a gradual increase. Fertilization in paddy fields shows an increase during the 1980s and 1990s (after the introduction of RD6). Possession of power tillers rapidly increased since 1993. Possession of eucalyptus farm forest, direct-seeded paddy, and the peddling business are stagnating in G village. As for non-farm occupations in G village, villagers mentioned the increase of employment as factory workers in Khon Kaen city during 1991–94. Possession of buffaloes and cattle shows a rapid fall, but some remain in G village. Finally, some villagers retain cassava cultivation, while others have turned to sugarcane production since 1997.

It is noticeable that there are three stages of development process in this area: 1) during the 1980s and early 1990s, 2) rapid changes around 1993–96, and 3) a new phase after the 1997 economic crisis.

What is outstanding in the first stage is the diffusion of HYV variety and fertilization of rice production.[19] Before the 1980s neither was common in this region. When the land-population ratio decreased into the critical point, some villagers moved into a new frontier to open up new land [Fukui 1993]. However, such frontiers vanished in the 1980s due to the conversion of forest into arable land. Inheritance practices also divided the land into smaller pieces. Thus, the only way to increase productivity was by applying new technologies. According to a middle-aged villager, many households in the village had larger holdings of paddy field in the past. Through the generations, however, the land was divided into smaller pieces and fertilizer was added to increase the production. These changes: a process that substitutes fertilizer for land, can be regarded as "factor substitution for land" [Hayami and Ruttan 1971].

In the second stage many indicators show rapid change. The process of this stage, however, shows differences between the two villages, in contrast to a similar process during the first stage. In G village, wage increases led villagers to work at factories in Khon Kaen and Bangkok. In the fields, more and more applied power tillers instead of using buffaloes. In P village, the peddling business became more common. The area under direct-seeded paddy

19) This was also associated with government campaigns to promote a "green revolution" in the region.

field and eucalyptus planting was also expanded. This stage: substituting machinery for labor, can be regarded as "factor substitution for labor" [*ibid.*]. During this stage, applying labor-saving crops such as eucalyptus was also one of the options for farmers in P village to cope with the change.

In P village, the rising wages and increase in non-farm employment opportunities led to increases in labor cost for farming and the number of persons engaged in the peddling business. They adapted to this situation by selling livestock, applying direct-sowing techniques in paddy field, and planting eucalyptus in the upland. The process was accelerated by following their neighbor's activities in the village. Currently, the importance of agriculture in the village is low. As one of the villagers stated, *tham na mai khum* (Farming does not pay). Direct-seeded rice cultivation and eucalyptus planting was accepted by them as the *sabai* (comfortable) farming.

In G village, most engage in miscellaneous non-farm employment, though the trend is similar to P village (i.e. increasing employment opportunities). Non-farm occupations here are neither stable nor profitable compared with that of P village. Villagers enviously call P village *muban setthi* (wealthy village), and complain that their village is different. Here, the importance of agriculture is higher. For example, more households possess cattle and buffaloes, employing transplanting techniques in rice cultivation, and some apply organic fertilizer. eucalyptus planting is also less significant than in P village.

Another factor that bore different responses is the information network through the peddling business in P village. Their activity covers the east to northeast region. In this village, it is easy to find people who can read the road map and add details to the map. The information obtained through various activities allows them to be sensitive to market information.

For example, they obtain second-hand clothes, one of their commodities, at Aranyaprathet located along the eastern Cambodian border. Some (10 households) bought eucalyptus seedlings in the east region on the way back home and planted them. According to a pioneer planter, he decided to bring back the seedlings and replace cassava, as there are plenty of eucalyptus plantations in the east, which seem better than cassava. He also knew that eastern seedlings are of a better quality than in the northeast region. After he planted eucalyptus, some villagers followed his behavior.

This also exemplifies how "cultural" aspects of villages affect their development paths, and their responses to external changes. Perhaps such "non-agricultural entrepreneurial spirit" was nurtured among them with the peddling business, and it was this business that bore structural differences toward G village.

What is outstanding in the third stage is the stability of indicators that had previously changed rapidly. Under such conditions, a new trend, post-planting trend is occurring for the management of eucalyptus farm forest; withdrawal from the management on one hand, and accumulation of the farm forest on the other.

Before the economic crisis, land transactions were common in this area. Especially in P

village, located along the main road, there were increases due to rising land values. There were 41 cases (22, 17, and 2 cases for paddy field, upland field, and unknown, respectively) in P village from 1990 to the surveyed period, while 21 cases (4, 13, and 4 cases for paddy field, upland field, and home garden) were reported in G village. Here it can be noted that 5 households (6 cases) in P village bought land from inside and outside villagers and planted eucalyptus. Of 6 cases, 3 cases were of 2 households that engaged in a large-scale peddling business. In addition, 2 cases of outsiders' planting eucalyptus were reported after they purchased the land.

Transactions of eucalyptus farm forest itself have also been reported. In Fig. 5, the number of households possessing eucalyptus farm forest decreased from 1997 to 1998. This is because 2 households sold their eucalyptus farm forest, while no new entries were reported. There are 7 such cases in the village, of which 4 cases occurred after the 1997 economic crisis. Four of the 7 were transactions inside the village.

At the same time, 7 cases by 7 households (4 cases from villagers, as stated above) showed the purchase of eucalyptus farm forest. Of these households, 5 were well-to-do villagers that have stable incomes (2 previously stated households, a household with a family joint business, and a household which operates a gas station along the road). In addition, 4 of the 7 occurred after 1997, and 3 of the 7 already owned eucalyptus farm forest and accumulated more land by purchase.

In G village, on the other hand, no cases of land transaction related to eucalyptus were found. Instead, one case of withdrawal from farm forest management was reported in 1998: uprooting it and replanting cassava. According to the villagers, eucalyptus requires a longer period to mature, and a larger initial investment. It damages top soil, because weeds do not grow around it after planting. It is also hard to replant other crops, for uprooting is labor intensive and requires additional investment.

Poor performances, lower than expected profits, a high cassava price in 1998 and decreasing trend of eucalyptus price (in real value) after the crisis lie behind the withdrawal from farm forest management shown in both P and G villages. The most serious problem is poor performances of eucalyptus stands. A seven year-old eucalyptus stand owned by villagers, probably having the largest biomass in this area, will provide only 6.9 tons of stem per *rai*.[20] This is a very low figure compared with an officially stated 15 tons per *rai* for a five-year stand [Thailand, Royal Forest Department 1996].

This is likely the result of infertile soil, mismanagement, and fire damage. It is said that eucalyptus should be planted on infertile soil where crop production is poor.[21] Especially in areas with saline soil, planting can help prevent further salinization by lowering the

20) Dry weight. The estimation was calculated under the following formula [Jamroenprucksa 1987].
$Ws = 0.0377\ (D^2H)^{0.9261}$
Where Ws, D, and H represent Dry Weight of Stem (t), DBH (cm), and Tree Height (m).

21) It is said the planting may go with agro-ecological risks such as reduction of surrounding crop yield, though such risks are not always "scientifically true."

groundwater level [Wada *et al.* 1994]. At least in this case, however, the low potentiality also lowered the performance of the eucalyptus, and hence its profitability.

Thus, the recent land transactions related to eucalyptus planting tend to differentiate farm forest management in P village, while G villagers are withdrawing from such management. Especially in P village, it has been accompanied by outsiders' acquisition of land and eucalyptus planting.

This change may be a structural change caused by the substantial nature of commercial tree growing; requiring less labor force, a larger investment, and a longer gestation period than cash crops. Similar events happened with other tree species. For instance, the Farmer's Tree Plantation Promotion Project (*khrongkan songsoem kasetakon pluk pa*) provided 3,000 baht for a five year investment and promoted planting economic tree species such as teak (*Tectona grandis*), Burmese rosewood (*Pterocarpus macrocarpus*) and neem tree (*Azadirachta indica*). During 1994–96, more than 80,000 participants and 1 million *rai* of farmland in this region were under this project [RDI 1996]. However, some criticize that more than half of the participants were not "farmers" [Anonymous 1997]. For outsiders such as land speculators, tree growing was an attractive option to wait and see the land market trend.

VI Conclusion

Based on field surveys in two neighboring villages near Khon Kaen city, northeast Thailand, this paper has examined how the recent changes in the rural economic environment affected the expansion of eucalyptus farm forest, and how the differences of the villages arose during the expansion process. Some post-crisis trends concerning eucalyptus farm forest in the villages are also described.

First, it was found that there were three stages of development in these villages: the factor substitution process for land, the factor substitution process for labor, and the process after the economic crisis.

Second, the differences in planting behavior arose as differences of response to the second stage of development. Both the history of each village and socioeconomic attributes of each household affected the response. For villagers in P village, who have a tradition of peddling business and substantial assets, eucalyptus planting is one option for responding to rising wage rates and non-farm job opportunities. In G village, where villagers have less stable non-farm employment and lower assets than P village, however, only a few had planted eucalyptus. Most retain the cultivation of field crops and some even hold negative opinions about this tree. Thus, the villagers' eucalyptus planting was one economic-rational response to recent changes in the rural economic environment caused by rapid economic growth, as well as the result of a strategic change of business sector and governmental intervention. In addition, "cultural" aspects such as entrepreneurial spirit and information network also play an important role in divergence. Further analysis is needed for understanding the interrelation of village culture, development path and villagers' responses toward external changes.

Apart from eucalyptus, commercial tree planting in general has gotten more and more common in this region, with the help of governmental projects. This suggests that the region had entered the first phase of "regenerative wood production," where production may substitute, to some extent, that of "exploitative" logging processes both inside and outside the country. Here, this phase had involved many villagers as the main suppliers of the products.

On the other hand, the region is currently entering into a second phase toward "regenerative wood production": from "planting" to "after the planting." It was also found that the recent land transactions, especially after the economic crisis, tend to differentiate the management scale of eucalyptus farm forest. Further, this also accompanies outsiders' acquisition of farm forest. This may suggest difficulties for small (and poor) farmers to sustain management under the current economic conditions.

Finally, some additional factors that seem to affect the second phase, such as marketing, trade, and legal aspects are not mentioned in the study. These are especially important for promotion of indigenous species plantation. Intensive surveys are required to examine how these points may stimulate or confine planting and what sort of intervention will be required for further development of regenerative wood production in the region.

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