Section 5

Changes in Environmental Conditions by Human Behaviours

Contents

		Page
1.	General back ground	467
1.1	Problems in Forest Land Utilization in the World	467
1.1.1	Influences of Forest Decrease: past and present	468
1.1.2	Problems of Forest Utilization in Tropical Area	473
1.1.3	Outlook of Land Utilization in the World and Problems in Statistics	474
1.1.4	Examples of International Optimism	478
1.2	Problems of Forest Development in Southeast Asia	483
1.2.1	Problems in the Philippines	484
1.2.2	Problems in Malaysia	486
1.2.3	Extensive Harvesting to Breeding Forestry	488
1.2.4	Shift of Timber Utilization to Low Level Log (Rationalization)	488
1.3	Indonesian Population and problems of Land Utilization	492
1.3.1	Change of Population Increase	492
1.3.2	Uneven Distribution of Population	493
1.3.3	Population Distribution and Land Productivity	494
1.3.4	Utilization of Land in Java Island Region	494
1.3.5	Land Utilization in Outer Islands	496
1.3.6	Outline of Immigration Plan	497
2.	Survey in East Kalimantan	498
2.1	Purpose of Survey	498
2.2	Method of Survey	499
2.3	Results of Survey	499
2.3.1	Society of Down Stream Area of the Mahakam River in East Kalimantan	499
2.3.2	Transmigrants	504
2.3.3	Tribe	506
2.3.4	Religion	506
2.3.5	Industrial Structure	507
	(1) Outline	507
	(2) Agriculture	508

2.3.6 Creation of Land Use Classification Map by Aerial Photo Interpretation 514
(1) Objective 515
(2) Precedent 515
2.3.7 Data Obtained by Aerial photo Interpretation (refer to classification map)..... 516
(1) Type of Forest 516
(2) Status of the Former Site of Log Utilization Development 516
(3) Status of Secondary Forest 516
(4) Status of Grassland 517
(5) Others 517
2.3.8 Use of Land Use Classification Map 517
(1) Log Utilization Development Plan 517
(2) Cultivation Plan 517
2.3.9 Expectation toward Interpretation of Aerial Photo .. 518
2.3.10 Suggestion of Field Survey by Land Use Classification Map of Interpretated Aerial Photo 519
2.3.11 Change of the Forest Utilization 523
(1) Change of the Development for Log Utilization . 523
(2) Change of the Production of Wood Products and Special Forest Goods 525
(3) Change of Production Form of Logs..... 532
(4) Change of the Distribution of Logs and Wood Products 535
2.3.12 Change of Forest Land Utilization 542
(1) A Story of rapid changing for grass land (interviewed on Nov. 7, 1980) 542
(2) Current Status of the Land Where Virgin Forest was Cultivated 18 Years Ago (interviewed on Nov. 7, 1980) 543
(3) Diminishing yield 545
(4) Tribes of Inhabitants and Traditional Farming . 545
(5) New settler of Bugis Tribe..... 546
2.3.13 Social Effects of Forest Exploitation..... 547
2.3.14 Disafforestation and Agriculture 550
(1) Disafforestation for transmigrant 550
(2) Disafforestation by Predecessors 561

2.3.15 Social Problems in rural area 571
(1) Grassland in forestland 571
(2) Use of Land After Logging and Social Problems .. 572
2.3 16 Outline of Fram Household Economy 577
2.3.17 Proposed Experiment from Murawalman University 580
(1) Experiment of Afforestation 580
(2) Proposal of Follow-up Investigation of Shifting Cultivation 592
2.3.18 Change of Timber Production and Distribution 592
2.3.19 Development of Log Process Industry 600
2.3.20 Future of Conversion of Forest Land to Agricultural Land 602
2.3.21 Increase in Importance of Afforestation 602
2.3.22 Reevaluation of Forest Resources 609

3. Conclusion 612
(1) Survey of Land utilization in Connection with Forests..... 613
(2) Experimentations on Improvement in Agriculture and Popularization 613
(3) Restoration of Forest Conservation 614

List of Literatures 616

List of Tables and Figures 618

1. General backgrouns

1.1 Problems in Forest Land Utilization in the World

From ancient times, the human being has repeatedly challenged nature with number of trial-and-errors. Especially since the beginning of this century, along with industrialization, an idea to conquer the mother nature has dominated the world.(35) However, the loss of balance in nature had brought various kinds of environmental pollution in front of our eyes.

Today, the sudden decrease of forest land is taking place throughout the world. If we fail to cope with this problem, it would end up in earth-scale disaster. The major concerns are the desertification of dry heath land and destruction of tropical rain forest which hold large standing stock and are vulnerable by large scale machines and vehicles. In many areas of the world, there are growing number of regions where calamities are induced, and environments are almost destructed by destroying forests beyond the limit of its resiliency and by ignoring to conserve forest for protection of agricultural environment. Although it took place at a certain period of history at certain limited areas, there has never been expanded to earth scale problem as it is today.

The expansion of farmland is becoming necessary because of the high increase of world population and improvement of living standard in terms of food. On the other hand, more and more farmlands are devastated due to improper treatment. It is the root of the fear for the future worldwide food shortage. Because of the uneven distribution of food, the number of malnourished people is already rising. It also sets off vicious cycle to accelerate the decrease of forest land.

Although this kind of problem could not be solved by one country alone, differences in international conditions make it quite difficult for countries to cooperate.

1.1.1 Influences of Forest Decrease: past and present

There is no or few, if any, forest in the area where ancient civilization had once prospered and ruined, as shown in Table 1. According to history books, there are many evidences which indicate the existence of forest in these areas in the past. These forests were destroyed by many reasons. Along with the progress in civilization and expansion of production, many places where recovery is slow or impossible came about.

In some cases, agriculture was depressed by the frequent weather calamities such as flood and draught which were induced by forest decrease. There are also many cases that, along with plague epidemics, national power was weakened to be collapsed internally or destroyed by invaders.

As for the human behaviours which decrease forest, since ancient times, there are three major factors such as the development for the purpose of utilizing timber for construction, the gathering of fuel materials for living and industries such as ceramics and metallurgy, and cultivation for farming and pasturage.

From ancient times, although there was almost no case that forest is destroyed only for the utilization of timber, there are many cases when forest is completely damaged by cultivation and gathering of fuel materials.

Table A1 Ratio of Area between Forest and National Land in Major Countries (calculation from FAO Production Yearbook 1973)

Developed Countries		Countries Appear in Ancient History		Developing Countries in Tropical Sphere	
Japan	69.0%	China	12.3%	Malaysia	71.2%
Finland	61.2	India	△20.1	Indonesia	64.0
Canada	44.4	Bangladesh	△15.7	Philippines	52.9
U.S.S.R.	40.6	Pakistan	2.3	Burma	57.5
U.S.A.	30.4	Iran	10.9	Old Indochina under French rule	56.3
West Germany	29.0	Iraq	4.3	Thailand	48.6
France	25.6	Afghanistan	3.1	Brazil	60.9
Italy	*20.6	Egypt	0	Columbia	45.0
U.K.	8.0	Ethiopia	△7.2	Gabon	74.7
		Greece	19.8	Cameroon	63.9
		Syria	2.8	Madagascar	21.2
				Senegal	△27.4
World Average	29.8				

* Related to ancient history

△ Country suffered from chronical famine

It is often considered that it was irresistable for ancient civilizations with no advanced sciences to underevaluate the risk of forest decrease which triggered their ruins. But in reality, as far as 2,300 years ago, there was a man who gave a warning against bare hills which are the result of forest destruction by pasturage. He is Mencius (BC 372-289), a Chinese philosopher.[35] However, his thoughts were never reflected on politics and Chinese forest had continued to decrease. Only there were many wars and, rises and falls of dynasties. In 1947, the age of the late Mao Tse-tung, the rate of forest area had decreased to mere 8%. Since then, by the efforts to restore forest, it is said to be recovered to 12% in 1970.

When we look at the Medieval history, say Western Europe of 14-15th Century, forest had drastically decreased by pasturage and gathering of fuel material for ceramics and metallurgy. As a result, flash floods had occurred in many areas which brought food shortage. At that time, the difficulty was tided over by the mass immigration to new continents, North and South America. On the other hand, there became an advanced place for forestry with establishment of silviculture. However, large portion of the land in these countries are flat and used for farming now. The rate of forest area are only 26% in France and 29% in West Germany.

Although there is a theory that forest area ratio of 30% is enough, it only means that many developed countries which have small amount of rainfall are in such status. In mountaneous country like Japan, the figure requires more than 60%. It is totally unknown what percentage is desirable for tropical rain forest.

The irregular climate in the U.S.S.R. is induced by the large scale reclamation of West Siberia in 1950s. Some people bring up this issue.(22) It is difficult to deny the influence of forest decrease on world climate such as big flood of the Volga River, big flood and occasional big draught in the Indian Peninsula in Asian Continent, and the irregularly high temperature of summer in Europe.

Concerning the weather calamities in south and north central part, and desertification of pasturage area in west central part of the U.S.A., one cannot ignore the influence of over-cultivation of surrounding areas which took place since the age of settlement.(22)

In the U.S., efforts were made in the development of protection forest of agricultural environment to separate large-scale farms. It is said that they got this idea from the forest protecting farmlands in Japan.

Japan is not exceptional in experiencing hard blow of drastic forest decrease on society and agriculture. Back in the 9th Century, a ban on deforestation was issued.(16)

The instability of politics and outbreak of wars, along with natural calamities, had afflicted people, especially farmers. In the 18th Century, Japan was often hit by famine. 1783's famine was particularly serious. Although the direct cause was natural calamity, history books state that it was political calamity because politics and society of that time were quite in chaotic state.[16] Rural communities were left impoverished, so once hit by natural calamity, farmers' resistence power was weak, and many were starved to death. Peasants had left villages behind and moved to cities, and that became the source of social instability. Finally, in 1978, riots broke out in 32 major cities all over Japan.[16,28]

This impoverishment of rural community had continued till Sontoku Ninomiya, a peasant philosopher (1787-1856), began relief activity. He admonished easygoing way of cultivation and preached philosophy of "conserving forest for water control" and "protection of agricultural environment." He said,"Forest clearing is a conflict between nature(forest) and human behaviour", and "Farming must keep harmony between nature(forest) and human behaviour". He exerted himself in recovery of devastated land from aspects of both farm and forestry.[28,35]

In his view, re-development of wasteland was primarily "to open hearts of people." And began from philosophical movement to open peasants' hearts and politics' hearts.[35] Cultivation and forest destruction had continued from 9th to 17th Century in Japan. Then trend had shifted to forest conservancy, river improvement and development of forest resources by Tokugawa Shogunate (Central Government) and other local clans. During Meiji and Taisho eras, with influence of western philosophy, forest had improved greatly. But in 1945, when the World War II ended, fields and mountains of Japan were again in disastrous state. Calamities brought by typhoon such as flood and landslide had destroyed farmland, sacrificed many human lives and caused food shortage through exhaustion of economy. Thus social instability had increased.

As being indicated above, there are many cases, including developed countries in forestry, where food production is afflicted as the consequence of forest destruction.

Table 2 Area of artificial forest of the world by region

(Unit: 1,000 ha.)

Region	Area of artificial forest	Region	Area of artificial forest
Canada	1,220	Europe	25,072
U.S.A.	10,353	U.S.S.R.	11,000
Central America	313	Asia	34,312
South America	2,418	in which Japan	8,863
Africa	2,821	Oceania	917
		World total	88,426

Source: World forest resources by Dr. Persson.
Survey period: 1965-1973 (differs from country to country)
The area of artificial forest in Japan was 10.02 million ha. as of 1977.

In Japan, however, the government had began to carry out large scale afforestation program. In 32 years, from 1946 to 1977, 10.02 million ha. of forest, which accounts for 27% of total national land, was created. The area of artificial forest in Japan had exceeded a little over 10% of world's total area of artificial forest.[29] (Table 2) In other words, annual average of 313 thousand ha. or about 10 trees per capita were afforested. Besides, 81% of the area of artificial forest was built by private sector.

This significantly high rate of afforestation area in Japan compared with that of the world indicates the relative lowness of level of afforestation efforts by other countries of the world. On the other hand, disappearance of forest in the world is significantly accelerated by the increase of food demand caused

by population explosion. It is clear that this disappearance is adversely affecting the world's agricultural food production. Tropical rain forest is regarded to be a type of area where hazard of forest decrease is likely to hit society hard.

1.1.2 Problems of Forest Utilization in Tropical Area

In Southeast Asia, area damaged by shifting cultivation is said to be reaching 25%-30% of the total area of that region. In the area west of India to Africa, status is much worse by over-pasturage. Although these lands are counted as pasturage land in statistics, the status is far more ruined than the former site of shifting cultivation in Southeast Asia. It includes virtual semi-desert. In countries of this area, such lands account for 40% to 60% of the total area of each country. In this region, shortage of food and firewood is a serious problem which is also an international problem.(10) This is caused by destruction of forest in dry land. Because the recovery is difficult, and further, population keeps increasing, famine in dry land becomes more serious. Thus, necessity of food aid increases.

This food shortage of worldwide scale has direct and indirect influences in Southeast Asia. Compared with this problem, problem of shifting cultivation is easier to solve. It would be important to consolidate grounds for food and resource problem by adequately coping at this time not only for the sake of more than three billion people who live in food shortaged area but also as a world policy.

In tropical area, pasturage in dry land decreases fertility and over-pasturage worsens it even more while farm in humid tropics is difficult to keep fertility. On the other hand, the maintenance of fertility in paddy field is considered to be relatively easy. Although much efforts were placed on the improvement of paddy field, there was no significant progress in the improvement of dry field farming because of technical difficulty. Compared with paddy field, contribution rate of extensive dry field farming to harvest is low, but one must not make light of this. Although

there are good land in tropical area such as Java Island, in general, it is not suited for farming in terms of soil. As for the forest, technology is needed to run productive forestry while maintaining vital power of forest as well as biomass in climax forest.

According to "Tropical geography" written by Dr. Pierre Gourou, a geographer specialized in tropics, high temperature and much rain in tropics liquefy chemical ingredients quite rapidly and precipitate minerals in soil. Through the process of such liquefaction and precipitation, soil will be tightly hard just like a sun-dried brick and become basic soil of bad physical nature. Because hard basic soil prevents the penetration of roots of trees, superior forest is difficult to grow. But forest, while repeating the alternation of generations over thousands of years, creates soft surface soil little by little through cultivating function of roots. Tree itself supplies large volume of fallen branches and leaves which will be resolved quickly owing to the high temperature and high humidity. The fumus is mixed with surface soil and make up fertile soil. It is said that inferior forest had gradually changed to superior forest through repetition of alternation of generations.(23)

As it is well known, even in case of huge tree in tropics, thickness of its surface soil layer is generally around 10 cm and rarely exceeds 20 cm.

When tropical forest is cleared to farmland, and if surface soil is washed away by heavy rain on such thin surface soil layer, the recovery of surface soil which was accumulated by forest over many thousands of years is quite difficult. From the actual observations, it is quite impossible to recover fertility within 10 to 20 years. Therefore, land gradually turns to grassland, if shifting cultivation is repeated with fallow period of 20 years or less.

1.1.3 Outlook of Land Utilization in the World and Problems in Statistics

Table 3 Outlook of Land Utilization in the World

Unit: Population, 100 million people,
Area, 100 million ha.

Name of Region	Population	Region		Arable land		Pasture		Forest		Others	
		Area	%	Area	%	Area	%	Area	%	Area	%
World	38.34	133.65	100	14.75	11.0	30.05	22.5	39.91	29.9	48.94	36.6
Asia	21.79	27.54	100	4.82	17.5	5.36	19.5	5.68	20.6	11.68	42.4
Europe	4.70	4.93	100	1.44	29.2	0.90	18.2	1.41	28.6	1.18	23.9
Africa	3.73	30.31	100	2.09	6.9	7.97	26.3	6.05	20.0	14.20	46.8
North America	2.33	19.34	100	2.35	12.2	2.69	13.9	7.36	38.0	6.94	35.9
Cental America	1.02	3.13	100	0.39	12.5	0.83	26.5	0.50	16.0	1.41	45.0
South America	2.06	17.83	100	0.87	4.9	3.85	21.6	8.97	50.3	4.15	23.3
Oceania	0.21	8.51	100	0.47	5.5	4.68	55.0	0.85	10.0	2.51	29.5
U.S.S.R.	2.50	22.40	100	2.32	10.4	3.75	16.7	9.10	40.6	7.22	32.2

Production yearbook 1975 (FAO)
(Statistical year 1973)

Table 3 is a statistics of FAO which shows the outlook of forest resources and land utilization in the world. Outlook of forest resources could be known by the area of forest and its basic data of each country. In 1967, FAO pointed out following two issues. (1) Extremely open forest and grassland are included in the category of forest. It is because by FAO's standard, grassland which is, if left untouched, expected to return to closed forest is regarded as forest. (2) The quality, quantity and conditions for forest development are not indicated. In spite of these facts, we have proceeded on forest development base on these figures. And even FAO itself had also suffered a bitter experience.(31)

The announcement of the fifth World Forest Inventory (WFI) was originally scheduled by FAO to take at the beginning of 1970s.

In spite of the efforts FAO made to improve statistics as reflective of reality, announcement was suspended. After then, Dr. Raider Persson, ex-FAO staff member, had compiled on behalf of FAO based on data gathered from governments of many countries. And with FAO's consent, he had published WORLD FOREST RESOURCES (WFR) from the Royal Forestry University of Sweden.

Dr. Persson conveyed FAO's view of writing in the preface of WFR that is "Out of forest resources in the world, only one third of data is scientifically surveyed and reliable. (Table 5) The rest are collected by appraisal."

According to WFR, efforts of FAO are visible by classifying: "Closed forest" is proper forest and "open forest land" is improper forest.

As shown in Table 4, announcement of Dr. Persson was quoted by the U.S. government in "The global 2000 report to the President."

According to the report, vis-à-vis total area of land in the world, total area of forest accounts for little less than 31% in which closed forest accounts for about 20% and open forest land, grass-land and others for remaining 11%.

Because not all of the forest in the statistics announced in 1960's by FAO was closed forest, FAO announced revised opinion in 1967. But, on the same year, an optimism which overevaluated the forest resource of the world was also announced by authoritative committee of U.S. Goverment.

Table 4 Area of forest in the world by region (1973)

Unit: million ha.

	Area of forest land			Area of total land	Ratio	
	Total	Closed forest	Open wood land			
		A	B	C	A/C	B/C
North America	630	470	176	1,841	25.5	9.5
Cental America	65	60	2	272	22	0.7
South America	730	530	150	1,760	30	8.5
Africa	800	190	570	2,970	6	19.2
Europe	170	140	29	474	30	6.0
U.S.S.R.	915	785	115	2,144	36	5.4
Asia	530	400	60	2,700	15	2.2
Oceania	190	80	105	842	10	12.5
World total	4,030	2,655	1,207	13,003	20	9.3
Error			168			1.3
Total	4,030	2,655	1,375	13,003	20	10.6

Source: Quoted from "The Global 2000 Report" by the U.S. government.
Data of Noth America and U.S.S.R are updated.

Definition: Closed forest - forest of more than 20% of crown density.
Open wood land - includes forest of less than 20% of crown density and grassland.
Land area excludes - Antarctica and Greenland.

Note) Total area of closed forest and open wood land does not match the total area of forest.

Table 5 Ratio of Forest Surveyed in the World by Region (1971)

Region	Ratio of forest surveyed	Region	Ratio of forest surveyed
All World	35%	Europe	74%
North America	60	U.S.S.R.	40
Central & South America	10	Asia	35
Africa	15	Oceania	20

Source: World Forest Resources (29)

1.1.4 Examples of International Optimism (34)

Two of the optimisms which gave international influence will be discussed herewith.

In 1967, President's Science Advisory Committee(PSAC) of the U.S.A. had announced an opinion that it will be made double cultivated area of the world. This opinion is often quoted as an indication of the possibility of food production increase.

Around 1965, area of cultivated land of the world was little below 1.4 billion ha. PSAC had claimed that area of cultivated land of the world could be expanded by about two times by cultivating unused cultivatable land of about 1.5 - 1.6 billion ha. existing in the world. This is why it is often called doubling-of-cultivated-land theory. In 1978, FAO had quoted this theory affirmatively in a report related to agriculture. (10)

Primary shortcoming of this theory is that it is based on clearing of 0.8 billion ha. humid tropical forest which accounts for 55% of expected "Doubling-of-cultivated-land." (20)

The U.S. Government's special report, "The Global 2000 Report to the President," which was submitted to the U.S. President in July, 1980 had denied this doubling-of-cultivated-land theory by ignoring it.(21)

However, this theory didn't lose its believers even after that event and continued to give influence on public opinion.(25)

The following is the report by FAO on the area of forest and commercial forest in the world.

Table 6 Area of Forest Land and Commercial Forest in the World

Unit: Million ha.

Classification		Area
Area of forest land in the world	*1	3,990
Area of commercial forest in the world	*2	2,180
Of which area of subtropical, temperate, frigid forest		1,330
Area of humid tropical forest		850

As shown in Table 6, remaining economic forest in humid tropical zone is 850 million ha. According to "tropical forest resources" (KATSURA WATANABE) in "1981 FAO forestry report No. 30," it amounts for 1.2 billion ha. including inferior forests which have crown density of about 20%. Cultivation of 800 million ha. out of this means to eradicate tropical forest from earth and has serious impact on environmental security in view of philosophy of "Conserve forest for water control".

PSAC states that out of 800 million ha. of humid tropical forest planned to be cultivated, 600 mil. ha. is omnipresent in Amazon River basin and Congo, 100 mil. ha. in tropical Asia, and the rest, 100 mil. ha. is located in other regions. It is quite doubtful that what kind of immigration policy is possible from densely populated Asia to sparsely populated Amazon and Congo.

Table 7 Potential Arable Land/Current Cultivated Land/Nonused Cultivatable Land of the World

Unit: 100 mil. ha.

	Population (1973) 100 mil.	Total area A	Area of potential arable land B	Area of current cultivated land C	Area of unused cultivatable land D	Usage rate C/B	Current cultivated land per capita ha
Africa	3.73	30.19	7.33	1.58	5.75	22	0.42
Asia	21.79	27.36	6.27	5.18	1.09	83	0.24
Oceania	0.21	8.22	1.54	0.16	1.38	10	0.76
Europe	4.70	4.78	1.74	1.54	0.20	88	0.33
North America	2.33	21.08	4.65	2.39	2.26	51	1.03
South America	2.06	17.52	6.80	0.77	6.03	11	0.37
U.S.S.R.	2.50	22.34	3.56	2.26	1.30	64	0.90
Others	1.02 *1)						
Total	38.34	*2) 131.49	31.89 *3)	13.88	18.01	44	0.36

Notes: *1 Central America

*2 Although data of PSAC lacks that of Central America, area was left as the source is.

*3 Although new statistics of current cultivated land is available the data was left as the source is.

On this point, the aforementioned "The Global 2000 Report" which was announced in 1980 by another U.S. Government agency denies indirectly the theory of cultivating 800 mil. ha. and warns the crucial decrease of tropical forest by 40% by the year 2000.

The reason of optimism is in the lag of scientific survey. In near future, security of food in tropical sphere will be an important issue. So, scientific survey on vast devastated land existing in humid tropics in terms of distribution, degree and cause of devastation and social influence must be settled first.

According to the "ASAHI" of Japan, dated June 15, 1981, in the UN's report "Status of World Population 1981", world population is forecasted to stabilize in the year 2110 with population of 10.5 billion. This report is quite optimistic about food productivity for population of 10.5 billion. It states that 6.6 billion people, 1.5 times of current population, could be nourished with current level of grain production, and the famine is problem of food distribution. Moreover, it introduced a research by Netherland which claims the possibility of grain production increase by 25 times of current level.

If people who depend largely on meat, including Americans, could put up with low level vegetable food, current grain production could nourish 7 billion people as stated in the UN Report. However, if all the people prefer to consume meat as much as Americans, only 1.5 billion people could be nourished. (26) Although it states that "famine is a problem of food distribution", no measure to equalize distribution is mentioned. Even if equalization was possible, it is doubtful that any kind of trade between food surplus countries and food shortage countries could solve the whole food problem fundamentally.

Furthermore, what peasants of shifting cultivation and famine stricken area want is neither 25 times production increase nor 2.5 times production increase. First, they require that production must be stabilized.

Apart from optimism, scientific survey with accurate evaluation is necessary in order to correspond to peasant's needs in time.

On the other hand, there is a theory that food supply and demand condition is turning for the better based on the fact that, in tropical Asia, the rate of annual average food production increase is 3.2%, while annual growth rate of population is 2.5%.[25] But considering the decrease of fertility by overwork of farmland, as in case of corn production in Thailand, research in this aspect is also important.

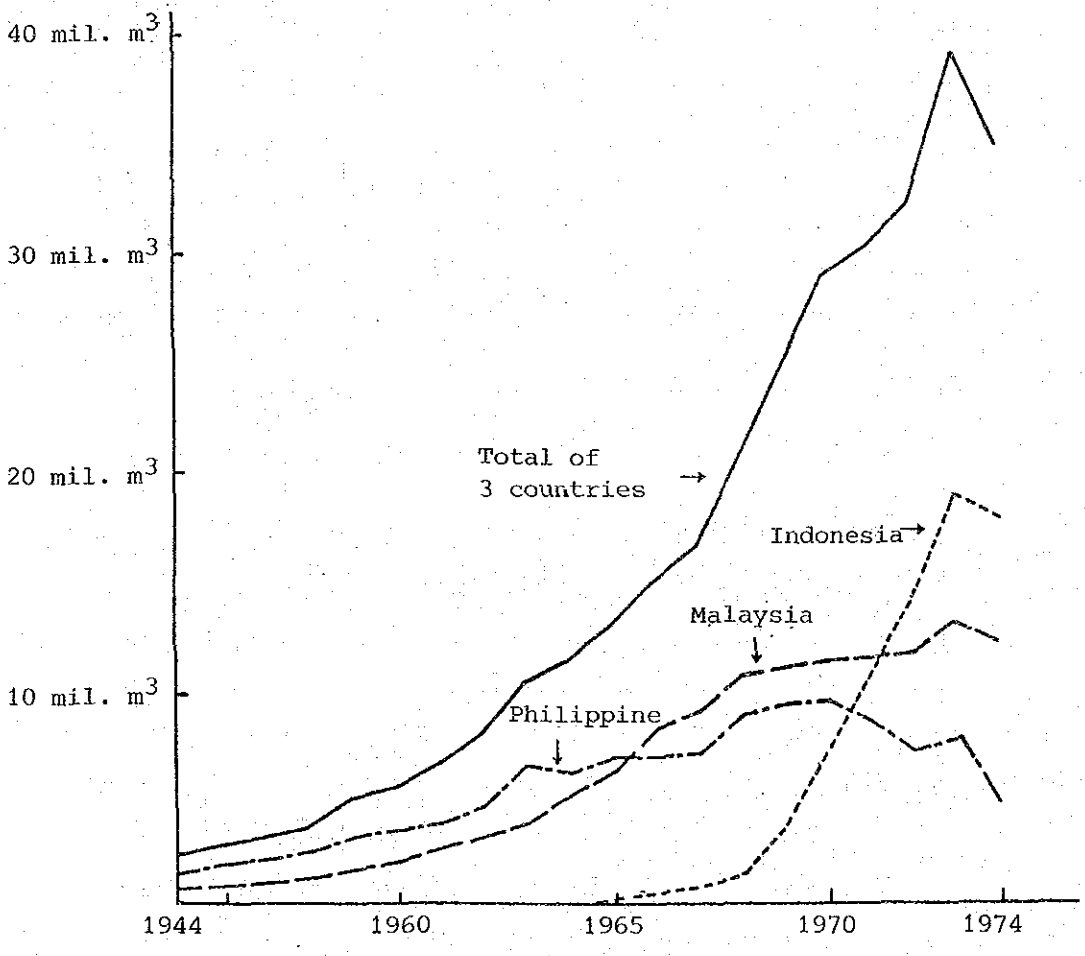
As such, in case of analyzing old statistical figures, it must be discussed based on the first hand scientific perception. Analysis of information concerning utilization of forest and forest land is particularly falling behind. Analysis based on scientific survey must be proceeded while acknowledging the deep relation between man and security of forest resource environment.

1.2 Problems of Forest Development in Southeast Asia

Production and trade of logs of the three countries (Indonesia, Malaysia, and the Philippines) which produce South Sea log had increased rapidly.

Fig. B1 Volume of World Trade (Export) of Log of Three Countries which Produce South Sea Log

Source: FAO



As shown in Figure B1, production and world trade of South Sea log had marked significant growth in 10 years beginning from 1965 to 1974.

Table B1 Chronological Changes in World Trade Volume of South Sea Log

Source: A Customs Statistics of Japanese Ministry of Finance

B Year Book of Forest Product FAO

Unit: 1,000m

Period	Source	Years	Accumlated volume	%	Converted to 5 year figure
1919-1949	A+B	31	5,190	1.6	865
1950-1954	B	5	9,433	2.9	9,433
1955-1964	B	10	59,421	18.1	29,711
1965-1974	B	10	253,695	77.4	126,848
Total 1919-1974		56	327,739	100	

As for world trade of South Sea log, the volume during 10 years beginning from 1965 to 1974 accounted for 77.4% of the total volume of trade between 1919 to 1974.

But total volume of these three countries hit ceiling in 1973, and supply structure of log had changed. In the Philippines and Malaysia, drastic decrease of their forest resources became a big issue. And all three producing countries turned their eyes to promotion of log process industry and stabilization.

1.2.1 Problems in the Philippines(31)

In this country, plantations were actively cultivated since around 1910. A part of Lauan logs (Dipterocarp type) which were produced on that occasion were introduced to Japan as a sample. Since World War I had broken out just after then, it didn't materialize as a full-scale export. As it is already mentioned, it was 1919 when trade was officially recorded in customs statistics in Japan.

Since distribution status of forest resource and locational condition of development in this country had enabled the use of machine which utilizes stolid Yarder of that time, mechanized forestry had settled in a way around 1935 although it was not so efficient compared with present.

Dipterocarp log was mainly exported to Japan, and products processed in the Philippines were mainly exported to the U.S.A. Volume of log exported to Japan before the war peaked to 0.74 mil. m^3 in 1937. The trade was suspended by the outbreak of World War II in 1942.

After the war, many tractors used by the U.S. military forces during the war were released and utilized for forestry.

Thus, the form of activity in mechanized forestry had changed. As a result, along with the rapid increase in production capacity of logs, some problems had arisen.

Philippines's post-war trade volume of logs had soon exceeded the pre-war's highest export record which amounted over 3 mil. m^3 in 1959. Around that time, some experts had begun to claim limit of forest development or over-deforestation. However, Philippines's trade volume of log had continued to increase to 9.6 mil. m^3 (about 3 times) in 1970, 11 years after then, as if denying the limit theory (Table B2).

As a result of aerial survey conducted with the US's support in 1970, the drastic decrease of virgin forest became clear. Taking this opportunity, the Philippines turned production of log to drastic decrease from peak of 1970. In 1979, Philippines production volume of log declined to less than 50% that of peak time, and its trade volume decreased to 13%. (Table B2)

By drastic production cut, many log producers had to quit business. Struck also by oil crisis, reemployment of forestry labour became an issue. The Philippines had promoted the log process industry. Annual consuming capacity of log was said to be 5 to 5.5 mil. m^3. But the average rate of operation was said to be around 60%.

The reasons are said to be the sluggish demand for wooden product in main exporting destination such as the U.S., Europe and Middle East, as well as domestic problem of loading wooden products on ship.

Along with the stagnant operation rate of log process industry, the total embargo of log already announced was not carried out. On the contrary, exporting volume of log to Japan in 1981 exceeded previous year's volume by 32%.(14)

On the other hand, the difficulty of natural regeneration of South Sea log resource began to be discussed among scholars. This was the base of the 20-year-old theory claiming limit on Philippines's resource development. This problem has remained unsolved without any academic research result nor appropriate measures. Time lag between raising question based on empirical observation and academic or policy oriented concern was great.

In the Philippines, shifting cultivation is prohibited by law because it destroys forest resources. But because no effective measure was taken to stabilize living of shifting cultivating peasants, 50-60 thousand ha. of forest was said to be burned and turning into field every year. Some people point out the decrease of water holding power, and rise of river bottom by influx of sand, along with the expansion of former site of shifting cultivation development as one of the reasons of recent floods especially frequently occurring in Mindanao Island.(15)

1.2.2 Problems in Malaysia(31)

In state of Sabah in Malaysia, the official area of forest is one third of that of the Philippines, and average standing stock volume per unit area is also only about two thirds of that of the Philippines. In spite of this fact, annual log production is maintaining in order of 16 mil. m^3 since 1976. (Table B2) This figure exceeds the peak annual production volume of 13.07 mil. m^3 (1970) in the Philippines, which is said to be over-deforestation. And it is estimated that about 0.32 mil. ha. of forest is developed every year. Total Dipterocarp forest including reserve forest

in Sabah State is 4.6 mil. ha. It means one fifteenth of all forest developed every year. Since official cutting cycle year is 35 years, one thirty-fifth of commercial forest area must be the limit of area which could be developed every year.

Even with considering error in the estimate of resources, the difference is extraordinary. We are intended to know the result of research survey on descrepancy between 1/15 and 1/35, and problem concerning security of reserve forest needed for land security. In any case as in the Philippines, at certain point of time, a drastic production cut is inevitable.

In West Malaysia State (Malay Peninsula), log processing capacity was increased by little more than 3 times between 1965 to 1973. Aerial survey had clarified that forest is drastically decreasing also in this region. Since the West Malaysia State strongly restricted the export of log at that time, log process industry of Singapore which was largely depended on Malaysian logs had changed main supplier to Indonesia. Table 3 shows the increase of export volume of log from Indonesia to Singapore. It nearly doubled from .755 million m^3 in 1975 to 1.412 million m^3 in 1979.

We must learn lessons from the above-mentioned forest development status in the Philippines and Malaysia and proceed this joint survey. There are two notable points concerning it.

First is that, as the view of FAO already quoted, the lag of worldwide scientific survey on forest resource which is indispensable for forest utilization. Second is, as experienced in advanced forestry countries, the difficulty of regeneration of broad-leaved forest by selective cutting system. The regeneration of Dipterocarp forest is particularly difficult in tropics where forest consists of various types of trees with various growth conditions.

We must consider that selective cutting itself is the factor of secondary destruction by inducing people into large forest through built roads for logging.

In order to utilize Dipterocarp resource effectively and to proceed smooth healthy regeneration, a survey like one conducted by the Second Section of this project must be proceeded continuously and improve quality as to be used by the policy makers.

1.2.3 Extensive Harvesting to Breeding Forestry[31]

Up to the present, many of the extensive harvesting in the world which produced superior log of large diameter from virgin forest had gradually declined after experiencing a climax period. Thus, there are many cases in forestry of advanced countries that created beautiful forests matching to virgin forest by its policy from virgin-forest-exploitation forestry to the breeding forestry. We think it is time to consider of switching to breeding forestry also in Southeast Asia.

The necessity of afforestation in Southeast Asia does not merely come from the security of log resource. We must also consider the recovery of former site of cultivation which accounts for few times larger than the area of former site of log production. Each country is considering of afforestation in policy based on the notion that it is urgent to restore social function of forest and fertility by planting trees in these lands. If it could be managed rationally, it is instrumental for the security of timber resource. For that purpose, the form of log utilization must be changed as follows.

1.2.4 Shift of Timber Utilization to Low Level Log (Rationalization)[32]

Superior forest resource of Dipterocarp family has fulfilled the mass supply and mass consumption of log. But today, supply of the log is forecasted to be insufficient worldwide. It is also true for superior log of Dipterocarp family, and the supply by the three producing countries is either stagnant or declining. (Table B2) Furthermore, it is considered that there is no forest

which could mass-supply in compliance with the resource. Therefore, rationalization of timber utilization becomes inevitably necessary. The shift of timber utilization from high level to the medium and then from medium to low level is the current world trend.

The rise of the plywood industry was aimed at producing wide board using medium diameter log because the supply of large diameter log to make wide wood product had decreased. That means the shift to lower level log was at the same time the rational utilization of timber. Recently, the shift to lower level log is proceeding. As shown in Table B4, in Europe, the total amount of production of particle board and fiber board exceeds far beyond that of the plywood. Moreover, Medium Density Board (MDB) and other panel boards are also developed.

The shift to the utilization of lower level timber must be considered to be related to the form of breeding forestry. In that case, superior large-diameter log of Dipterocarp family would rather be a precious material log.

About statistics:

Various statistics were quoted. The figure was selected by following standards in case there was difference between FAO's data and respective governments' data.

1) In case of making international comparison, FAO's data was used if possible. For example, Table B2 and B4.

2) In case FAO's data was not available, Governments' announcements were used. For example, Table B3.

3) Year period of FAO's data is calendar year, and that of Indonesian government is fiscal year.

Table B2-4 Change of Production and Trade of Three South Sea Log Producing Countries (Log for Lumber and Plywood)

Yearbook of Forest products 1952-1977 Unit: 1,000 m^3

	Philippines		Indonesia		Saba		Sarawak		W.Malays		Total	
	Production	Export	Production	Export	Production	Export	Production	Export	Production	Export	Production	Export
1950	3,052	765	1,319	127	178	122	231	89	1,155	4	5,935	1,107
1	3,043	870	1,290	107	255	133	238	71	1,310	3	6,136	1,184
2	3,043	1,613	1,684	175	275	101	394	129	1,489	1	6,885	2,019
3	3,381	2,586	1,947	178	289	161	482	188	1,407	0.3	7,506	3,113
4	3,623	1,353	1,959	168	535	355	463	134	1,429	0.3	8,009	2,010
S.30.5	4,301	1,565	3,883	186	634	451	653	155	1,680	--	11,151	2,357
6	4,631	1,943	5,354	195	779	542	638	137	1,770	0.1	13,172	2,817
7	4,829	2,102	5,367	141	976	749	690	139	1,696	2.4	13,558	3,133
8	5,298	2,540	4,830	97	1,166	914	654	149	1,675	6	13,623	3,700
9	5,453	3,187	5,004	97	1,576	1,386	881	341	1,715	6.7	14,629	5,018
	40,854	18,524	32,637	1,471	6,663	4,914	5,324	1,532	15,326	180	100,604	26,458
1960	6,038	3,512	5,361	115	2,160	1,711	1,172	349	2,305	24	17,036	5,689
1	6,599	3,776	5,474	105	2,823	2,254	1,202	493	2,279	41	18,175	6,632
2	8,305	4,794	5,594	117	2,811	2,469	1,376	696	2,965	8	21,051	8,084
3	9,415	6,522	4,023	115	3,478	3,001	1,700	875	3,130	61	21,746	10,574
4	9,130	6,144	4,100	135	3,562	3,384	1,844	865	3,570	889	22,206	11,417
S.40.5	10,015	6,700	4,150	150	4,153	3,799	2,306	1,207	3,780	1,037	24,404	12,893
6	8,105	6,800	4,300	295	5,200	4,856	2,986	1,934	4,360	1,403	24,951	15,288
7	8,975	7,200	4,800	531	5,674	5,321	3,599	2,244	5,130	1,471	28,178	16,767
8	11,950	8,791	5,500	1,333	5,892	5,796	4,233	2,988	6,100	1,730	33,675	20,638
9	13,020	9,421	7,000	3,685	6,180	6,187	4,330	3,051	6,430	1,862	36,960	24,206
	91,550	63,660	50,302	6,581	41,733	38,778	24,748	14,702	40,049	8,467	248,382	132,188
1970	13,072	9,606	10,780	7,834	6,546	6,150	4,693	3,128	7,440	2,076	42,531	28,794
1	11,012	8,443	13,805	10,822	6,941	6,558	3,917	2,549	7,620	2,041	43,295	30,413
2	10,977	6,858	16,921	13,354	8,496	7,708	3,177	1,999	9,060	1,889	48,631	31,808
3	11,440	7,759	26,297	18,500	11,050	10,144	3,255	1,894	9,305	849	61,347	39,146
4	10,190	4,693	21,732	16,873	12,550	9,745	2,830	1,687	8,613	744	55,915	33,742
5	7,278	4,596	16,696	12,884	11,533	9,002	2,514	1,258	7,539	533	45,560	28,273
6	8,570	2,331	23,800	18,105	16,024	12,077	4,413	2,958	9,594	470	62,401	35,941
7	7,820	2,047	24,550	18,932	16,024	12,337	4,883	3,475	9,766	307	63,043	37,098
8	7,169	2,200	25,000	19,200					31,469	16,713	63,638	38,113
9	6,578	1,248	26,900	19,407					31,469	16,084	64,947	36,739

Source: Yearbook of Forest Products (FAO) 1950-1979

Table B3 Export of Logs by Country of Destination from Indonesia 1975-1979

Unit : 1,000 m^3

Country of Destination	1975	1976	1977	1978	1979
Japan	7,587(55)	9,932	9,483(48)	9,238(46)	9,708(50)
South Korea	2,741(20)	3,501	4,829(24)	5,187(26)	4,449(23)
Taiwan	2,163(16)	2,581	3,369(17)	3,432(17)	2,569(13)
Singapore	755	1,026	1,127	1,396	1,412
Other Asian Counerics	227	225	273	321	607
Italy	221	489	296	356	405
Other Europian Countries	212	744	372	204	212
America	4	11	40	35	22
Australia	11	12	7	9	4
Other Countries	—	—	11	21	101
Total	13,921(100)	18,521(100)	19,807	20,199(100)	19,489(100)

Note: Number in ( ) indicates the percentage(%) of total
Source: Directorate General of Forestry

Table B4 Change of Wood Products and Production Volume in the World

(Unit: 10 thousand m^3 or 10 thousand tons)

Distinction / Country	Lumber 1965	Lumber 1973	Plywood 1965	Plywood 1973	Particle board 1965	Particle board 1973	Fiber board 1965	Fiber board 1973	Papers 1965	Papers 1973
Africa	340	497	40	78	5	30	11	19	59	120
Canada	2,578	3,644	184	265	15	56	84	114	976	1,258
U.S.A.	8,644	9,123	1,281	1,805	148	635	558	802	3,787	5,270
Central America	1,312	1,665	55	135	16	72	27	52	256	467
Japan	3,329	4,466	271	890	17	65	52	83	730	1,597
S.E. Asian Countries	489	705	49	137	—	—	—	—	—	—
Other Asian Countries	2,189	2,983	96	406	10	40	28	46	442	762
3 Scandinavian Countries	1,920	2,424	65	92	51	212	176	173	732	1,205
E C	2,167	2,531	229	286	382	1,140	113	118	1,322	1,951
Other West European Countries	1,019	1,304	33	66	67	299	30	42	252	476
East Europe	2,344	2,622	141	161	122	286	77	149	627	805
Oceania	562	582	18	21	10	46	25	26	110	169
U.S.S.R.	11,549	12,036	171	267	79	310	101	191	468	789
World Total	38,442	44,582	2,633	4,609	922	3,191	1,282	1,815	9,761	14,869

Source: Calculated from the Yearbook of Forest Products (FAO) (B6)

1.3 Indonesian Population and its Problems of Land Utilization

1.3.1 Change of Population Increase

Table C1 shows the change of population increase in Indonesia. In 48 years, the population had increased by about 2.25 times from about 60.73 million in 1930 to 136.40 million in 1978. The average annual increase rate in 48 years is about 1.7%. The problem rises from the fact that the increase rate, which was 1.25% during 1930 to 1948, began to grow year by year. At one time in 1970s, it had reached an annual rate of 2.4%. Although it is said that the increase is staggering, the annual average increase rate during 7 years from 1971 to 1978 was 2.0%.

Therefore, in 1930s, the annually increased number of population was about 0.9 million, but recently, the population is increasing by 2.7 million every year. This fact because it is attained by the improvement of nation's nourishment and decline of death rate since around 1950s. However, on the other hand, locally, especially in Java Island, over-population is becoming a problem.

Table C1 Change of Population Increase in Indonesia

Unit: 1,000 people

Year	1930	1937	1948	1961	1971	1978
Population	60,727	67,398	76,360	97,019	119,232	136,416
Index A	1.00	1.11	1.26	1.60	1.96	2.25
Index B			1.00	1.27	1.56	1.78
Population increase rate %/year		1.3%	1.2%	1.6%	2.0%	2.0%

Source: J.M. Hardjono, Transmigration in Indonesia
1930 = Population Trends in Indonesia by Widjojo Nitisastro
1937, 1948 = Production Yearbook FAO
1961, 1971 = Biro Pusat Statistik
1978 = Biro Pusat Statistik
Index A : based on 1930
Index B : based on 1948

1.3.2 Uneven Distribution of Population

Population of Indonesia is extremely concentrated in the region of Java Island (including Madura Island and Bali Island). As shown in Table C2, population density of Java region in 1978 was as high as 663 persons per 1 square kilometer. This is about 2.1 times higher than that of Japan and exceptionally high also by world standards.

On the other hand, in archipelago other than Java region, with total area of 13 times larger than the Java region, the number of inhabitant are 47.80 million and population density per 1 square kilometer is only 27.5.

Table C2 Change of Population and Density of Indonesia by District

	Java and Madura	Sumatra	Kalimantan	Sulawesi	Others	Total
Area sq. km.	132,174	473,606	539,460	189,035	570,070	1,904,345
1930						
Population(1,000)	41,718	8,255	2,169	4,232	4,353	60,727
Density per sq.km	316.1	17.5	4.0	22.4	7.6	31.9
1961						
Population(1,000)	62,993	15,739	4,102	7,079	7,106	97,019
Density per sq.km	477.0	33.0	7.6	37.0	12.4	51.0
1971	*1					
Population(1,000)	76,102	20,813	5,152	8,535	8,630	119,232
Density per sq.km	565.0	38.9	9.0	37.0	15.0	59.0
1978						
Population(1,000)	87,617	23,695	6,204	9,817	9,083	136,416
Density per sq.km	662.9	50.0	11.5	51.9	15.9	71.6
		27.5				

*1 Includes Bali Island

Source: 1930 = Population Trends in Indonesia by Widjojo Nitisastro.
Others = Biro Pusat Statistik.

1.3.3 Population Distribution and Land Productivity

The cause of imbalance of population distribution mentioned before is primarily the difference of land productivity, that is the level of fertility.

The region of Java Island is especially fertilized and an eminent agricultural zone in the tropics of the world. Most of the region is newly born volcanic ash zone of good quality with excellent chemical and physical nature.

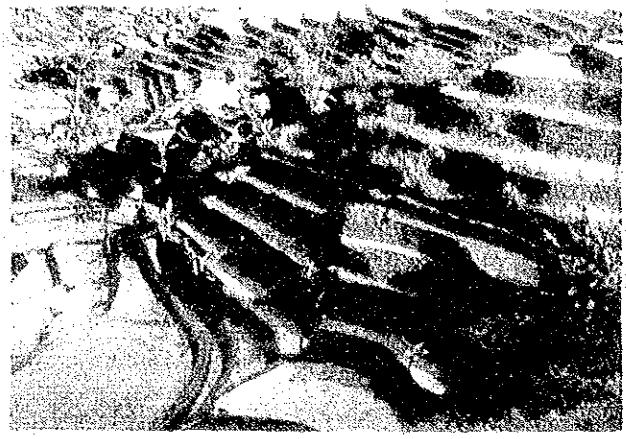
In some parts of the outer islands, there are also newly born volcanic ash zones. But most of the area are zones of old soil. So, aged as humid tropical soil, it is much inferior than that of Java Island in terms of fertility.

1.3.4 Utilization of Land in Java Island Region

In Java Island region, the pressure of over-population is bringing many problems into the utilization of land. The area of Java Island region accounts for 7.2% of the total area of Indonesia. But in 1978, its population was 87.2 million, which accounts for 64% of the total population. According to the official of Immigration Bureau, the capacity of Java Island region is 70 million people. Moreover, population is increasing by about 2 million annually in this region alone.

In 1930s, when population of Java region was in the order of 40 million, land was enough, and rice and sugar were exported from this island. But rural community of today cannot accommodate the expanded population. So, overflew population had flowed into cities which caused social problems. On the other hand, many people went to mountains to cultivate. Photo 1 shows that status. It shows the terrace type paddy fields.

Photo 1



Terrace Type Paddy Field of Central Java

Such a scenery could be seen in many places in Java Island and Bali Island. Behind this beautiful scenery, there are many problems such as forest conservancy and river improvement, agricultural policy and population policy.

Paddy fields have advantage over shifting cultivation fields in slope in terms of controlling water and soil. But in case of water overflow, terrace banks often collapse. It is believed and reported on newspapers that collapsed soil will influx into rivers, raise the river bottom and increase chance of flood.

As a measure to solve such problem, Indonesian Government is promoting transmigration program from Jave Island region to other islands.

1.3.5 Land Utilization in Outer Islands

Transmigration to the outer islands with small population density is natural consequence. But the reason of sparse density population in the regions is the difficulty of maintaining farming because, unlike that of Java Island, fertility is low and exhaustion of land fertility is very quick.

In Java Island, grassland which is the former site of shifting cultivation is rarely seen. But in outer islands, as shown in Table C3, it is quite common.

Table C3 Area Damaged by Shifting Cultivation in Indonesia

Region	Total Area A	Damaged Area B	Ratio B/A
Sumatra	About 4,700 mil. ha	About 1,120 mil. ha	23.8%
Kalimantan	About 5,400 mil. ha	About 1,000 mil. ha	18.5%
Sulawesi	About 1,890 mil. ha	About 1,200 mil. ha	63.5%
Others (excludes West Irian)	About 3,050 mil. ha	About 370 mil. ha	12.1%
Total	About 15,040 mil. ha	About 3,690 mil. ha	24.5%
Area of Japan	About 37 million ha.		

Note: Based on National Progress on Forest Indonesia (Directorate General of Forestry of Indonesia) 1956-65

According to the announcement by the Directorate General of Forestry of Indonesia, as shown in Table C3, about 25% of all the area excluding Irian, which is 150 million ha, is the former site of shifting cultivation. In Sulawesi, 64% of all the area is grassland which is the former site of shifting cultivation. The rate of grassland is extremely higher than that in Kalimantan. This is because of the difference in locational condition for settlement.

In Sulawesi, it was easy to enter into the inland, rather than the difference in fertility.

The soil of the former site of shifting cultivation turned into grassland is usually hard and has bad physical and chemical nature. Over thousands of years, trees had constituted virgin forest with huge trees and stored nourishment in ecological system. But, the thickness of surface soil layer is often around 10 cm only. So if once cultivated to bare land, the tropical environment of much rainfall forces to erode and degrade of the soil, thus end up in grassland.

Moreover, the grassland gives bad influences on the region. For example, if it is extended grassland on mountain side, it is difficult to run a stable farming in flat part of the mountain foot for long time.

Hereafter, it is desirable to increase population absorbing power of this region by scientifically establishing classification of land use, engaging in conservation of forest, improvement of land, propagation of cultivating technique and also introduction of other industries.

1.3.6 Outline of Transmigration Plan

The Indonesian Government is promoting transmigration plan from Java region to outer islands as well as the active family planning.

transmigration to the East Kalimantan by the third program will be discussed later. Concerning the long term view of the transmigration plan, an official of Immigration Bureau told, "it is planned to immigrate 2 million households, about 10 million people, deliberately from Java Island region to outer islands in 20 years from 1981 to 2000. "This planned transmigrants are considered to prime the pump water to encourage voluntary immigrants.

2. Survey in East Kalimantan

2.1 Purpose of Survey

Examples are not few that dry up of resources and aggravation of the environmental conditions caused by human behaviours have played a role in the decline of many civilizations. One of the biggest factors is the destruction of forest.

The largest factor which forces to change forest resources and environment is the cultivation for food production. Especially, the extensive farming and pasturage are regarded to be the sources of big damage. The extent which development for log utilization destroys forests directly is not always great. The area of sacrifice by it is less than that by cultivation. In tropical Asia, the influx of farmer by forest road constructed by forest exploitation is a problem (Katsura Watanabe). However, the problem is the subject of social policy, not of forest exploitation itself.

Today, the international shortage of food is influencing greatly on the decrease of forest owing to the worldwide population explosion and shift of eating habits to meat accompanied by the improvement of living standards.

The development of Dipterocarp forest resource which is regarded to be the last remaining high quality broadleaf forest resource in the world with significant size has already passed its limit of exploitation, and it is decreasing in the Philippines and Malaysia.

No place on earth can be free from the influences of above problems in internationally oriented contemporary societies. Therefore, international problems are also included in the purposes of survey. The contents are as follows.

(1) Study of historical and social problems concerning forest utilization in Indonesia and in the world.

(2) Survey on change and social problems of forest development in Southeast Asia.

(3) Survey on change and social influences of forestry in East Kalimantan.

(4) Survey on current status of forest land use and influences on people's lives and environment in East Kalimantan, particularly the problem of shifting cultivation and former site of it.

2.2 Method of Survey

(1) Survey was conducted by the following method. As for the related problems, participated surveyers compile through joint discussions based on publications and data.

(2) Through interpretation of aerial photos, creation of great-sphere land use classification figure was requested to the first group. And the way to utilize the figure will be discussed.

(3) Survey and data gathering in old villages where shifting cultivation was done in the past, in new villages where planned transmigrants and voluntary transmigrants live, in forest development sites and in their surrounding villages was conducted.

(4) Results of field survey and gathered data was discussed for analysis and filing. Discussion has been held in Mulawalman University and Tokyo participated by the surveyers of both countries.

2.3 Results of Survey

2.3.1 Society of Down Stream Area of the Mahakam River in East Kalimantan

The local administrative organization of Indonesia consists of prefecture (Kabupaten), which is divided into counties (Kecamatan). A county consists of villages (desa or Kampung) which is the terminal organization of the administration. Further, village is divided into a neighbor group (RT = Rukun Tetangga). Status of population is shown according to these administrative organizations.

The number of county (Kecamatan) amounts to 340: 7 in the city of Samarinda, 4 in Balikpapan City, 30 in Kutai Prefecture, 9 in Pasir Prefecture, 7 in Berav Prefecture, and 13 in Bulungan Prefecture. As an example, area and population by village in the Samboja County of Samarinda City where survey was conducted are shown in Table D4.

Samboja County is located in Samarinda City and is adjacent to Balikpapan City. Sungai Seluang Village where county office is located is also known as an oil producing area and is attracting settlers. The area of the county is 78,000 ha., total number of household is 4,932, total number of population is 22,283 (1980) and population density per square km is 29. There are 13 villages in the county, and they differ greatly in area. Salak Api Laut Village has only 500 ha. for population of 934, while Sungai Merdeka Village has 34,400 ha. for 3,315 people. The average figures of villages in the county are 6,000 ha. of area, 1,714 of population and 29 people per square km of population density. The average number of people in a family in the county is 4.5.

Kutai Prefecture has 30 counties. One of them is Muara Kaman County which consists of 11 villages including Muara Kaman which is the main village located by the Mahakam River. The area is as large as 272,903 ha. with 1,965 households and 12,284 people. So the population density is only 5. To show the general image of villages by using average figures of the 11 villages, one village has the area of 24,800 ha.,174 households and 1,117 people. Compared with Samboja County, the area of village is large, and population is small. The average number of people in a family is 6.3 which is bigger.

Table D1 Area and Population of Samboja County by Village (1980)

Name of village	Area 1000 ha.	No. of house-hold	Popula-tion	Popula-tion density, people	No. of people per family
1. Sei Seluang	3.000	388	2,006	666	5.2
2. Sei Merdeka	34.463	781	3,315	10	4.2
3. Margomulyo	3.363	161	684	20	4.2
4. Amborawang Darat	2.537	319	1,200	47	3.8
5. Amborawang Laut	3.077	243	1,039	34	4.3
6. Salok Api Darat	2.805	374	993	35	2.6
7. Salok Api Laut	515	295	934	181	3.2
8. Wonotirto	1.517	290	1,388	91	4.8
9. Samboja Kuala	9.326	772	3,554	38	4.6
10. Tanjung Harapan	2.660	211	977	36	4.6
11. Sanipah	6.316	400	1,757	28	4.4
12. Handil Baru	6.050	600	3,073	51	5.1
13. Ma Sembilang	2.443	288	1,363	56	4.7
Total	78.072	4,932	22,283	29	4.5

Source: Samboja Kecamatan

Sebulu County in the same Kutai Prefecture is located in the down-stream of the Mahakam River from Muara Kaman. There are 6 villages including Sebulu Village in center which is about 5 hours distance in the upstream of the Mahakam River by a boat-taxi from Samarinda. The total area is 104,400 ha., number of household is population is 9,223 and population density is 9. Average figures in a village are 17,400 ha. for the area, 324 for the number of households, and 1,537 for population. The average number of people in a family is 4.7.

Table D2 Area and Population of Muara Kaman County by Village (1980)

Name of village	Area 1,000ha.	No. of house-hold	Popula-tion	Popula-tion density persons/ km^2	No. of people per family
1. Muara Kaman Ulu	26.7	315	2,879	11	9.1
2. Muara Kaman Ilir	21.1	165	1,444	7	8.7
3. Muara Siran	29.7	175	860	3	4.9
4. Rotan Hampang	21.1	96	556	3	5.8
5. Benua Puhun	18.4	175	1,245	7	7.1
6. Teratak	19.7	190	1,131	6	6.0
7. Sabintulung	26.9	411	2,133	8	5.2
8. Tunjungan	29.5	152	400	2	2.6
9. Sedulang	25.4	180	1,045	4	5.8
10. Menamang Kiri	27.7	40	199	1	5.0
11. Menamang Kanam	26.6	66	383	2	5.8
Total	272.9	1,965	12,284	5	6.3

Source: Muara Kaman Kecamatan

Table D3 Area and Population of Sebulu County by Village (1980)

Name of village	Area 1,000ha.	No. of house-hold	Popula-tion	Popula-tion density persons/ km^2	No. of people per family
1. Segihan		224	924		4.1
2. Sebulu Ilir		290	1,419		4.9
3. Sebulu Ulu		461	2,142		4.6
4. Beloro		288	1,393		4.8
5. Tanjung Harapan		275	1,189		4.3
6. Selerong		428	2,138		5.0
Total	104.400	1,946	9,223	9	4.7

Source: Sebulu Kecamatan

Table D4 Number of transmigrant per Year in All Indonesia

Year	Transmigrated family	Transmigrated population
1971	4,171	18,870
1972	11,314	51,918
1973	21,412	101,881
1974	11,000	46,613
1975	8,100	34,985
1976	13,910	63,237
1977	22,500	99,453
1978	25,079	110,818
West Kalimantan	1,000	4,239
Central Kalimantan	-	-
South Kalimantan	2,148	9,529
East Kalimantan	2,409	10,620
Total	5,557	24,388
Ratio of Kalimantan	22.2	22.0
1979	24,486	106,714
West Kalimantan	199	830
Central Kalimantan	325	1,341
South Kalimantan	1,239	5,660
East Kalimantan	450	1,773
Total	2,213	9,604
Ratio of Kalimantan	9.0	7.3

Source: Statistical Pocketbook of Indonesia, 1978/1979, 1979/1980

2.3.2 Transmigrants

Transmigration to the state of East Kalimantan was amounted to 4,733 families with 19,317 people in 1969/70 which was before the beginning of the first development program period. Since then, although there were ups and downs, the transmigration had been continued. And by 1979/1980, the number of transmigrated family and population reached 15,090 and 63,966 respectively. By the breakdown of regions, Kutai Prefecture is the largest in number of transmigrated family and population that accounts for 46.1% and 45.5% of total respectively. It can be regarded as the center of transmigration The next largest place is Balikpapan City which accounts for 25%. The number of these settlement by transmigrants amounts to 29. Some of our surveyed places were also settlements by transmigrants such as Lempake which is located near Samarinda City, Teluk Dalam of Kutai Prefecture, Wonotirto Village of Samboja County, Sungai Merudeka Village, and Ambo Rawang Darak Village. (Refer to Table D8)

Table D5 Number of Accepted Transmigrants and Population of East Kalimantan

	Samarinda	Kutai	Balikpapan	Pasir	Bulungan	Total
Prior to the program (1954-1968)						
Number of family	1,043	2,092	1,245	353	-	4,733
Population	3,915	8,534	5,352	1,516		19,317
1st development program (1969-1973)						
Number of family	989	1,223	154	351	95	2,812
Population	4,305	5,651	591	1,528	425	12,500
2nd development program (1974-1978)						
Number of family	300	100	2,500	1,000	100	4,000
Population	1,373	398	11,131	4,220	481	17,603
3rd development program (1979-)						
Number of family	0	3,545	0	0	0	3,546
Population	0	14,546	0	0	0	14,546
Total						
Number of family	2,332	6,960	3,899	1,704	195	15,090
Population	9,593	29,129	17,074	7,264	906	63,966
Settlement number	3	17	4	4	1	29
Number of family (%)	15.5	46.1	25.8	11.3	1.3	100.0
Population (%)	15.0	45.5	26.7	11.4	1.3	100.0

Source: Buku Data Transmigrasi di Kali-Tim 1981

2.3.3 Tribe

The characteristics of the Indonesian society, "multi-tribal society", is the same also in Kalimantan. In general, Dayak is the original tribe of Kalimantan, but locally, there are also Banjarnese and Kutainese. In the coastal areas, other tribes have transmigrated for commercial and transportation purposes. Recently, Javanese have come in as transmigrants. There is no data to clarify the reality of tribes in all regions. To show the data of previously stated survey field as an example, in Kuala Samboja Village of Samboja County, the people consisted of 2,029 Bugisnese (67%), 751 Banjarnese (25%), 195 Javanese (6%), 32 Kutainese (1%) and 24 people of other tribes (1%).

In Sebulu Ulu Village of Kutai Prefecture, Kutainese who are the major tribe in the region accounted for 73%, Javanese 25%, Banjarnese 1% and Bugisnese 1%. In Muara Kaman County, Kutainese had accounted for 60%, Banjarnese 20% and the rest 20% consisted of Dayak, Bugisnese and Javanese.

2.3.4 Religion

In Indonesia, Islam which is worshiped by 89.9% of the total population (1976) plays a major role. The second largest religion is Christianity, but it accounts for only 5.9%, followed by Hindu which accounts for 1.9%.

When we regard the status of religion in East Kalimantan province, there are 1.296 Islamic mosgues, 327 Christian (Protestnat) churches and 109 Christian (Catholic) chapels (1978). It shows the highest propagation of Islam.

To show an example from the survey field, in Kuala Samboja Village mentioned before, most people are Islam which numbered 3,277 (99%), and only a few were Christians. In Wonotirto Village of the same Samboja County, there were 1,333 Moslems(96%), while there were only 55 Christians (Protestant) (4%). The rate of Islams is over-whelmingly high in Samboja County.

In Teratak Village of Muara Kaman County, there were 975 Moslems (87%), 90 Catholics (8%), 40 Protestants (4%), 9 Pentecosts (1%) and 8 of other religions (1%). The number of Christians combined accounts for 13%.

In Case of Sebulu Ulu Village, Moslems were overwhelmingly many with 2,677 (99.8%), and there were only 5 Christians and 1 Buddhist. In general, Islam was propagated to every corner of the rural communities in East Kalimantan. And Islamic mosgues and chapels built in each village occupy the central place of peasants' daily lives.

2.3.5 Industrial Structure

(1) Outline

East Kalimantan Provinces is the largest province in Kalimantan Island with more than 20 million ha. of area. Its population is 1.018 million (1978), and population density is as low as 5. Petroleum and timber are produced there. Recently, large-scale agricultural development by farmers is in progress. Consequently, the annual increase rate of population shows more than 5% and development is grandually proceeding.

The production volume of petroleum in 1974 was 9.05 million barrel (5.2% of Indonesia's total production), but in 1978, it has increased by 2.4 times to 21.91 million barrels.

Timber is the important resource as well as petroleum. As it is described thoroughly in other part, only the outline about timber is discussed here. The area of forest in East Kalimantan is 17.24 million ha. which accounts for 85% of total land area in this Province. In other words, it accounts for 14% of Indonesia's forest area. Further, 68% of forest in the state of East Kalimantan are production forests.

The timber production of East Kalimantan has reached significant volume in 1968. In 1969/1970, the cut area was 0.07 million ha., and log production was about 0.32 million m^3. But in 1978/79, the cut area and production increased to 0.25 million ha. and 10 million m^3 respectively. The production volume accounts for

about 40% of total production of Indonesia which made here the center of forest development in Indonesia. Among produced logs, Meranti accounts for little more than 80% and plays important role also in export. In 1978/1979, East Kalimantan's export volume of log was about 8.87 million m^3 which accounted for about 44% of all the export of log of Indonesia.

Since 1980, the export volume of log have dropped considerably due to the government's policy to restrict export of log. But as a supplier of log to related industries in the Province including the wood industry settlement at the Mahakam River basin near Samarinda, the log is still an important resource.

As for the marine products, in 1978, total of 55 thousand tons was produced, out of which are 32 thousand tons in sea water fishery and 23 thousand tons in fresh water fishery.

(2) Agriculture

1) Number of Farm households, Area of Farmland

In the agriculture of Kalimantan, there are two types of managing entity which is refered to as double structure of agriculture of Indonesia. One is small scale farm household, and another is the large scale estate. The farm housrhold is managed by peasant based on the traditional agricultural methods. Foods for in-house use are produced by family laborers, and they sell surplus products. Or in part, merchandized products such as coffee and rubber are produced. Small scale farm households including settlers are the dominant in this category.

The estate agriculture was originally capitalistic large scale management owned by foreigners before the World War II. By employed laborers, exporting products such as rubber, palm oil, and coffee were produced. But after the independence, they were nationalized.

According to the 1973 Agricultural Census, number of farm house in East Kalimantan is 57,594, area of farmland was 92,533 ha. and average farmland per family is 1.61 ha. In case of the transmigrant settlers' farmhouse, as 2 ha. of land is distributed to each family, and cultivatable land of up to 5 ha. was distributed, the average scale after then must have been increasing with the continuation of transmigration.

Table D6 Number of Farmhouse, and Estate, Area of Farmland, and Average Size in Indonesia by Region (1973 Agricultural Census)

Region	Farm household			Estate			Total of farmland
	Number of Farm household	Farmland, ha.	Average ha.	Number of estate	Farmland, ha.	Average ha.	
Sumatra	2,847,068	3,802,749	1.34	594	1,314,367	2,213	5,117,116
Java, Madura	8,664,446	5,505,215	0.64	774	677,562	875	6,182,777
Bali, Nusatengala	-951,832	1,208,726	1.27	41	16,199	395	1,224,925
Kalimantan	689,195	1,864,144	2.71	85	59,255	697	1,927,399
West Kalimantan	(273,500)	(981,978)	(3.59)	(38)	(14,984)	(394)	(996,962)
Central Kalimantan	(100,277)	(524,093)	(5.23)	(11)	(5,768)	(524)	(529,861)
South Kalimantan	(257,824)	(269,540)	(1.05)	(31)	(36,147)	(1,166)	(305,687)
East Kalimantan	(57,594)	(92,533)	(1.61)	(5)	(2,356)	(471)	(94,889)
Sulawesi	1,101,187	1,523,485	1.38	236	128,007	542	1,651,492
Maluku, Irian	119,814	259,862	2.17	72	30,255	420	290,117
Total of Indonesia	14,373,542	14,168,181	0.99	1,801	2,225,645	1,236	16,393,826

Source: Statistical Pocketbook of Indonesia 1978

There are only 5 estates, and the combined area is 2,356 ha.

According to the 1973 Agricultural Census, the area of farmland managed by farmers in East Kalimantan was 92,533 ha. Breaking down the utilization conditions of paddy field and dry field, paddy field was 20,980 ha.(22.7%), and dry field was 71,553 ha. (77.3%). The rate of paddy field is low in comparison with that of all Indonesia.

Table D7 Area of Paddy Field and Dry Field in Indonesia (1973)

Unit: 1,000 ha.

Region	Total of farmland		Paddy field		Dry field	
	Area	%	Area	%	Area	%
Sumatra	3,803	100	1,400	36.8	2,403	63.2
Java, Madura	5,505	100	4,235	76.9	1,270	23.1
Bali, Nusatengala	1,209	100	363	30.0	846	70.0
Kalimantan	1,868	100	511	27.4	1,357	72.6
West Kalimantan	(982)	100	(188)	19.1	(794)	80.9
Central Kalimantan	(524)	100	(69)	13.2	(455)	86.8
South Kalimantan	(269)	100	(233)	86.6	(36)	13.4
East Kalimantan	93	100	21	22.6	72	77.4
Sulawesi	1,524	100	552	36.2	972	63.8
Maluku, Irian	260	100	2	0.8	258	99.2
Indonesia	14,168	100	7,063	49.9	7,105	50.1

Source: Statistical Pocket Book of Indonesia 1978/1979

Note: 1) Based on 1973 Census. But area of dry field was calculated by subtracting (2) paddy field from (1) farmland.

As an example, area of land by type of village (kampung) as follows. That is to say, utilization of land is different according to the old/new of village, and economic conditions and boundary of village. Kuala Samboja Village is an old village in Samboja County located by the coast where County Office was once placed in 1917. There are 900 ha. of orchard land in total including coconut farm (800 ha), rubber farm (50 ha.) and other fruit trees. The average area of farmland per family is 2 ha. Wonotirto Village in the same county was first cultivated by transmigrants in 1957. Paddy field is the main type of land usage and account for 16.5% of total land. And the average size of farmland is 1.8 ha. Sebulu Ulu is a village facing the Makaham River. Recently, by the establishment of water way for irrigation, fields are changing to paddy fields. Its average size of farmland is 2.4 ha. All the villages have huge forests which are the lands for shifting cultivation. The area of shifting cultivation in coastal village of Kuala Samboja is about 1 ha. per 1 household, while it is 1-2 ha. in Sebulu Ulu and Wonotirto Villages.

Table D8 Examples of area by type of land use in villages

		Kuala Samboja (1980) a	Sebulu Ulu (1980) a	Wonotirto (1981) b
Area ha.	① Paddy field	50	800	250
	② Dry field	250	300	75
	③ Orchard land	900		
	④ Houseland, garden farm	75	17	95
	⑤ Forest, grassland	7,801	7,984	711
	⑥ Lakes and marshes	-	1,000	202
	⑦ Others	150		184
	⑧ Total	9,226	10,101	1,517
Composing ratio %	Paddy field	0.5	7.9	16.5
	Dry field	2.7	3.0	4.9
	Orchard land	9.8	-	-
	Houseland, garden farm	0.8	0.2	6.3
	Forest, grassland	84.6	79.0	46.9
	Lakes and marshes	-	9.9	13.3
	Others	1.6	-	12.1
	Total	100.0	100.0	100.0
⑨ Nunber of farm household		643 *	461 **	230
Average size per household $\frac{①+②+③+④}{⑨}$ ha.		2.0	2.4	1.8
⑩ shiftng cultivation field ha.		300	600	460

Note: 1) * Total number of farmers and fishermen

2) ** Total number of houses in villages

Source: 1) a is based on inerview at site.

2) b is based on data of village. As for shifting cultivation by interview.

The following table shows the percentage of products produced in East Kalimantan against the total volume in Indonesia. Although rice in dry field exceeds 3%, other products are below 1% in terms of both area and produced amount, which indicates the small role that East Kalimantan plays in food production at present. (Refer to table D12)

Table D12 Rate of major agricultural products produced in East Kalimantan (1978)

	Area 1,000 ha.				Production quantity 1,000ton				Production quantity per ha.	
	All Indonesia		East Kalimantan		All Indonesia		East Kalimantan		Whole country	East Kalimantan
		%		%		%		%	ton	ton
Paddy field rice	7,698	51.7	33	38.4	24,172	52.7	67	36.0	3.14	2.03
(%)	(100)		(0.4)		(100)		(0.3)			
Dry field rice	1,231	8.3	43	50.0	1,599	3.5	63	33.8	1.30	1.47
(%)	(100)		(3.5)		(100)		(3.9)			
Total of rice	8,929	60.0	76	88.4	25,771	56.2	130	69.8	2.89	1.71
(%)	(100)		(0.9)		(100)		(0.5)			
Corn	3,025	20.3	3	3.5	4,029	8.8	2	1.1	1.33	0.67
(%)	(100)		(0.1)		(100)		(0.1)			
Cassava	1,383	9.3	5	5.8	12,902	28.1	44	23.6	9.33	8.80
(%)	(100)		(0.3)		(100)		(0.3)			
Sweet potato	301	2.0	1.4	1.1	2,083	4.5	9	4.8	6.92	6.43
(%)	(100)		(0.4)		(100)		(0.4)			
Peanut	506	3.4	0.8	1.0	446	1.0	0.5	0.3	0.88	0.62
(%)	(100)		(0.2)		(100)		(0.1)			
Soybean	733	4.9	1	1.1	617	1.3	0.8	0.4	0.84	0.80
(%)	(100)		(0.2)		(100)		(0.1)			
Subtotal	5,948	40.0	11	12.8	20,077	43.8	56.3	30.2	3.75	5.12
(%)	(100)		(0.2)		(100)		(2.8)			
Total of major products	14,877	100	86	100	45,848	100	186.3	100	3.08	2.28
(%)	(100)		(0.6)		(100)					

Note: This statistics does not include all the products.

Source: Statistical Pocketbook of Indonesia 1979/1980
Date of East Kalimantan is same as in Table D13.

2.3.6 Creation of Land Use Classification Map by Aerial Photo Interpretation

Upstreaming the Mahakam River which flows through Samarinda City to the northwest for about 80 km, there is Sebulu Village where P.T. Kutai Timber concession is located. We have obtained an aerial photo of the company's forest concession and a topographical map.
An interpretation of the land usage divisions was ordered for a 20,000

ha portion of the photograph and the results laid over the topographical map. The value and possibility of utilizing this sort of map in the future was demonstrated by this.

The value and possibility of utilizing this sort of map in the future was demonstrated by this.

(1) Objective

Among the missions, the following are most important. (1) apply academic research results of other division to the community. Or conversely, (2) to find issues those are reguired to be solved for the community, and suggest to a researcher, policy makers and the general public in order to solve it.

Consequently, in addition to the field survey to gain base for characteristic classification, it is necessary to grasp accurate issue in broad perspective and to seek an appropriate measure. For that purpose, it is required to know the status of land use classification of broad region and to grasp issues from broad perspective. The utilization of the aerial photo interpretation is the right method for this purpose. Characteristic and pertial field survey will be the premise and enables is grasping of issues by determining adequate survey field effectively.

(2) Precedent

The accurate topographical map and forest type map are indispensable for the making of development plan and its business management. Aerial photos have been used in limited section since prewar days.

However, in the age when it was difficult to use them scientifically and economically, in general, it took lots of labor and time to repeat ground survey to obtain these two maps, and it was the only way. and time, this activity had been the hindrance of making a long term plan.

Since the aerial photos interpretation have begun to be used, survey period has shortened considerably, and maps became very accurate. That is, as for the topographical map, an accurate map can be obtained by inputting aerial photo into graph machine. And as for the forest type map, the classification is possible

by aerial photo interpreter if classification standards are suggested by people with experience. Tropical rain forest will be classified according to its purpose into huge forest, very high forest, high forest, medium forest and low forest. Furthermore by interpreting the type of forest which equalizes land conditions, form and color of crown, we can classify the dominant species group. As same classification of land use, soil and vegetation can also be performed. So if a typical district is chosen and sampling ground survey is conducted, it is possible to clarify conditions of location, classification of land use, standing stock of forest, and composing tree species. If secondary analysis of aerial photo based on these data is deciphered, maps for specific purposes such as detailed forest type map with amount of standing stock by tree species for forest development, classification map of land utilization, etc. as well as the distribution status of forest for development and non-development in all forest area could be made.

2.3.7 Data Obtained by Aerial photo Interpretation (refer to classification map)

(1) Type of Forest

17 classes of forest type, including 2 types of swamp forest, are obtained by standards such as (1) 3 stages by the height of trees, (2) 3 classes by the size of crown's diameter and (3) 3 classes by the crown density. Decipherment for the tree species was not performed.

(2) Status of the Former Site of Log Utilization Development

Classification was done into the selective cutting district of slight degree and excessive degree.

(3) Status of Secondary Forest

On the photo, secondary forests which seem to have grown on the former site of shifting cultivation were classified into 2 categories such as extremely young forest and very young forest. As for the identification of heath, adjustment by field survey is necessary.

(4) Status of Grassland

Classification was performed into 3 categories by the height of grass.

(5) Others

Plantations, paddy fields, swamp and villages were deciphered.

It was found out that it is possible to diagrammatically classify more than 28 kinds of land utilization.

2.3.8 Use of Land Use Classification Map

(1) Log Utilization Development Plan

Already described.

(2) Cultivation Plan

Superior cultivated field must meet conditions such as good forest with topography and location suited for products.

For that purpose, investigation by overlapping forest type map and other vegetation map over the topographical map, contrasting with utilization classification defined by Group 1, and, further, by examining the ground survey, could dentfy the land selection.

In selecting the cultivating land, not only the forest land but also, in many cases, swamp and grassland could be the candidate by use of irrigation. Tall tree forest not always turns to good quality cultivated land. There are difference in thickness and humidity in surface soil layer of forest land depending on the composition of tree species in tall tree forest.
If the location of forest to be developed or cultivated is marked on the map, the layout of roads, necessary buildings and facilities could be pre-determined on map by overlapping it over the topographical map again. Through this procedure, outdoor survey could be proceeded quite rapidly and effectively.

Aerial photos interpretattion are not only used in wide area distribution survey of land classified in terms of status, such as former site of development, shifting cultivation and its former site, secondary forest, grassland, and swamp, and degree of devastation, as well as research to support academic work. It is also the characteristic of this survey research to combine it with field survey by many experts to make utilization classification of land.

2.3.9 Expectation toward Aerial Photo Interpretation

It is known that there is correlation between type of tree and physical nature of soil and form of trunk(moreover, the volume of trunk). Therefore, the development of technique to dentify major tree species in aerial photo is important.

Just as it is possible to identify tree species on ground by observing form and color of crown from distance, it must also be possible to identify it on photo. Some kind of tree species was identifiable in limited range in the past experiments. For example, in Shorea spp, there are tree groups of soft and hard materials.
These two groups could be identified by the color of crown taken in photo, and the validity is examined by ground survey to a certain extent.(30) But it is not sufficient to apply for aerial photo interpretation, yet. Further development of scientifical identification technique is desired.

And at the same time, if the relation between tree species and crown form becomes to be used academically, it is expected that the area of aerial photo utilization would expand as well as quick survey.

The reclamation of transmigration settlement during the period of this field survey which lasted for about 1.5 years has brought drastic change in forest and forest land. Aerial photos were used in these cultivation plans. But the necessity of preliminary survey by interpretation concerning the change after reclamation or influences which reclamation gave on neighboring forests is recognized. It was concerned that shifting cultivation with short fallow period might intrude along logging road. Periodical examination by aerial photo is also efficient in forest management.

2.3.10 Suggestion of Field Survey by Land Use Classification Map of Interpreted Aerial Photo

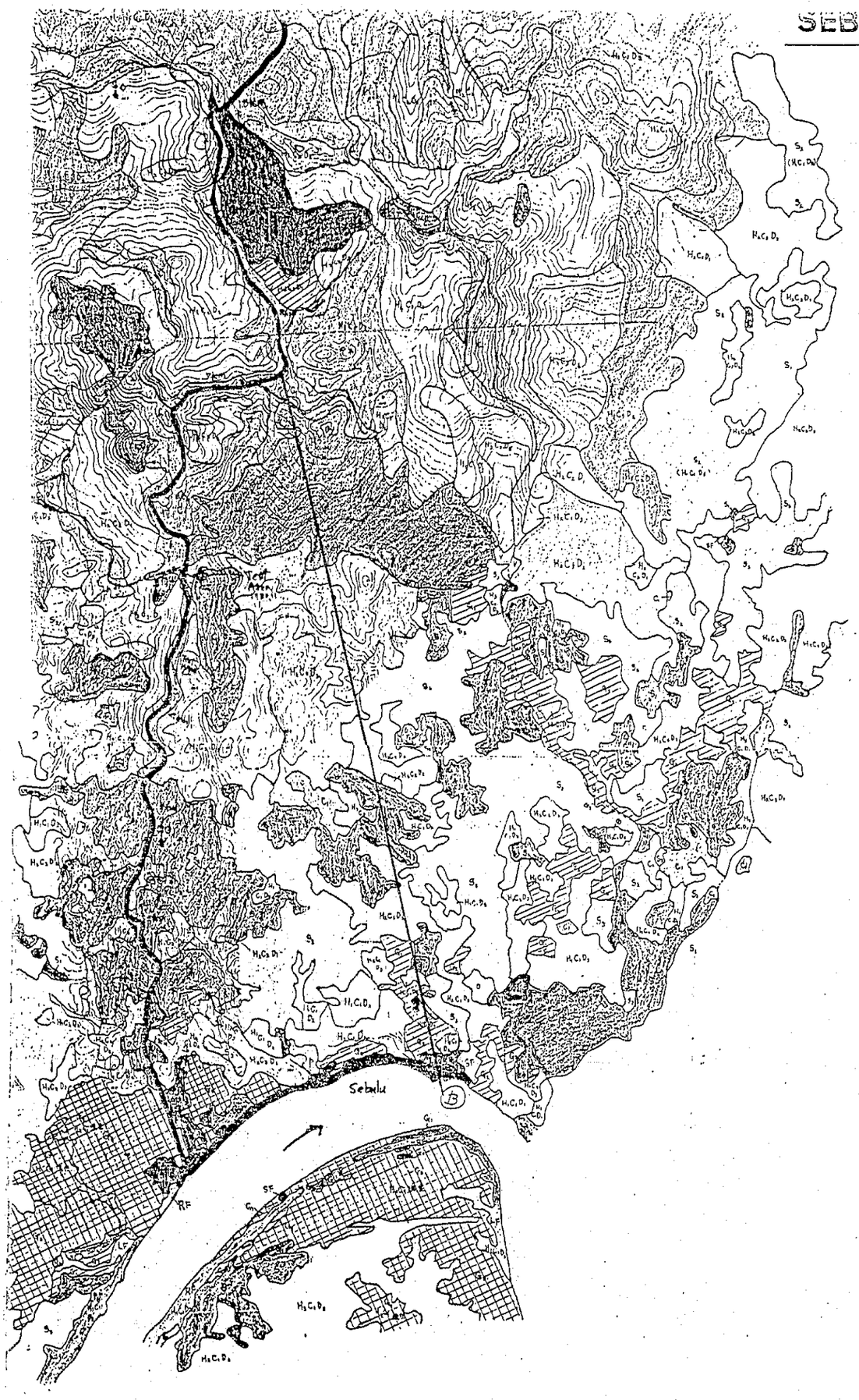
In order to conduct survey by using aerial photo, it is necessary to follow the following procedures.

(1) According to the purpose of survey, determine items and standards of photo interpretation by experienced personnel.

(2) Interpretation is performed by these specialists. Topological map and land utilization classification map are made. Depending on necessity, geographical features chart, geological features chart or soil map will be made.

(3) Based on the data obtained, a field survey plan is made through brain storming by the party concerned. In some cases, the final decision of the survey plan must be preceded by the preliminary survey. The extent of this research was limited to the clarification of a method to use aerial photos.

SEBULU (EAST KALIMANTAN PROVINCE)



LEGEND

- C_1 Selection forest
- C_2 Clear cutting forest
- SF Shifting cultivation
- P Paddy field
- Grass (Low)
- Grass (High)
- Grass (Natural)
- S_1 Young secondary forest
- S_2 Old secondary forest
- WF_1 Wet Lowland forest
- WF_2 Wet Lowland forest (Swamp)
- Village
- LF Levee forest
- RF Rubber Plantation
- Ⓟ Pure forest

- $H_3 C_3 D_3$
- $H_3 C_3 D_2$
- $H_3 C_3 D_1$
- $H_3 C_2 D_2$
- $H_2 C_3 D_2$

- H 1 Trees height 19 m. and less
- H 2 Trees height 20 – 30 m.
- H 3 Trees height 30 m. and up
- C 1 Crown diameter 10 m. and less
- C 2 Crown diameter 10 – 20 m.
- C 3 Crown diameter 20 m. and up
- D 1 Crown density (Dominant) 40 % and less
- D 2 Crown density (Dominant) 41 % – 69 %
- D 3 Crown density (Dominant) 70 % and up

Date of Photography : July . 1972

Scale 1 : 20.000

0 1 2