MASTER PLAN REPORT
FOR
TRENGGANU SWAMP AREA INTEGRATED AGRICULTURAL DEVELOPMENT
MALAYSIA

MAIN REPORT

FEBRUARY 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

MASTER PLAN REPORT
FOR
TRENGGANU SWAMP AREA INTEGRATED AGRICULTURAL DEVELOPMENT
MALAYSIA

MAIN REPORT

FEBRUARY 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In 1977, the Government of Malaysia requested to the Government of Japan the cooperation for a survey on the utilization of swamp areas in Trengganu Tengah District as well as for the comprehensive agricultural development plan comprising the farming of rice and upland crops, animal husbandry and fisheries.

The Japan International Cooperation Agency (JICA), entrusted with its work by the Japanese Government, dispatched to Malaysia in February 1978 a preliminary survey team, and in August that year a 17-expert team headed by Dr. Y. Mochizuki of the Taiyo Consultants Co., Ltd to conduct a feasibility study on the Bukit Bauk Pilot Project.

In 1979, JICA dispatched again a master plan study team headed by Dr. Y. Mochizuki to conduct the survey of the whole swamp areas in Trengganu Tengah region, on the basis of the findings of the previous feasibility study.

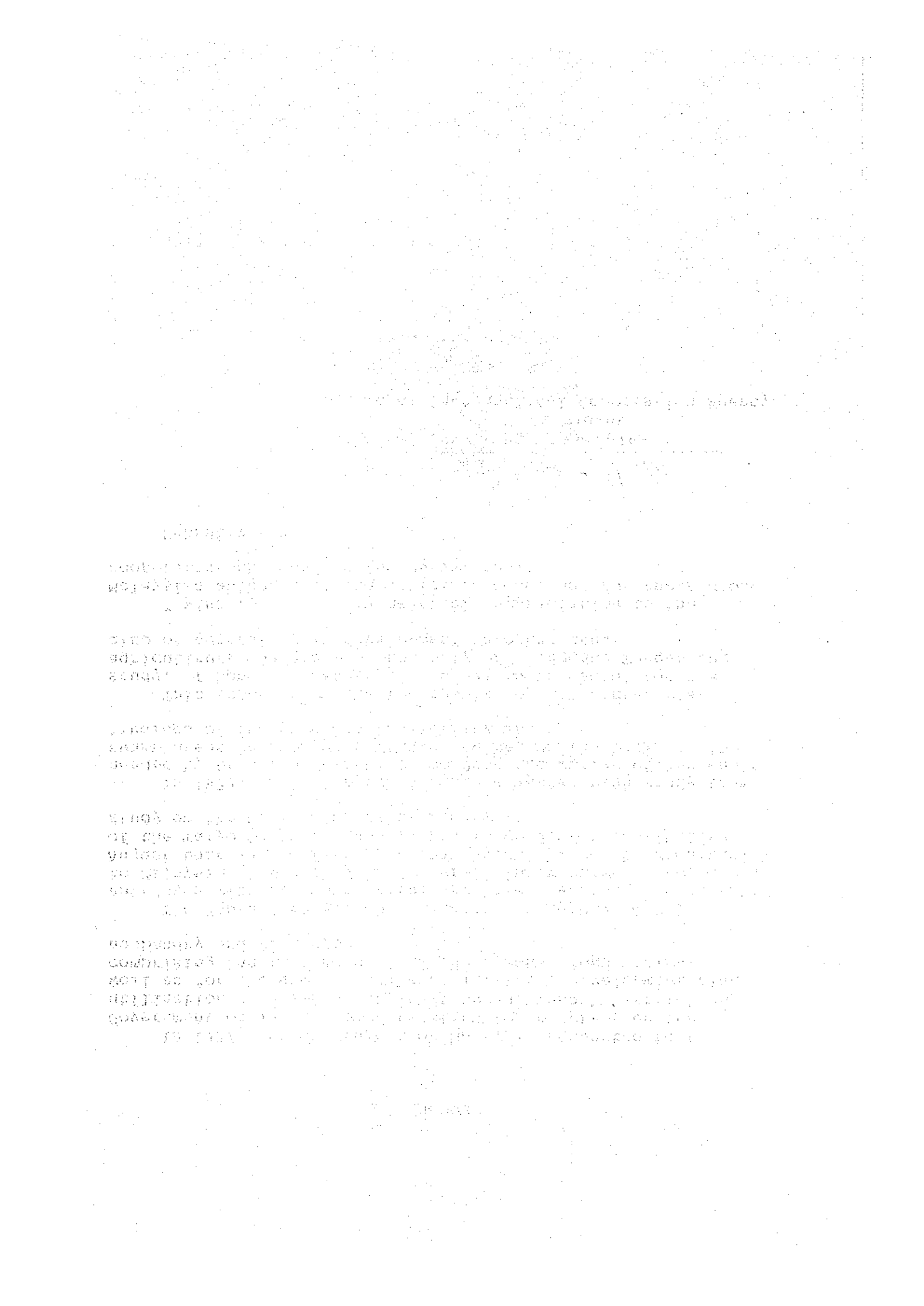
This report compiles the results of the master plan study. I hope the report will prove to be useful for the agricutltural development not only of Trengganu Tengah but also of general swamp development in other areas.

I wish to express my heartfelt appreciation to the Malaysian authorities and officials concerned for their close cooperation extended to the survey teams.

February 1980

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency



LETTER OF TRANSMITTAL

February, 1980

Mr. Keisuke Arita
President,
Japan International Cooperation Agency,
Tokyo

Master Plan Report for Trengganu Swamp Area
Integrated Agricultural Development, Malaysia

Dear Sir,

We have the honor to submit herewith the Master Plan Report on the captioned project in accordance with the agreement concluded between the Government of Japan and the Government of Malaysia.

The objective of the project is to study on existing conditions and agricultural utilization methods of swamp areas which are scattered in southern Trengganu. The master plan study has been continuously executed from the feasibility study of Bukit Bauk pilot project in 1979.

With the helpful advice and assistance offered by the Advisory Group and the Malaysian Government, we were able to conduct the commissioned field survey successfully for a period of about three months from June to September 1979, during which an interim report containing the basic scheme of the planned agricultural development was presented to the Malaysian Government. After our return to Japan, the data collected during the survey were put to a rigid analysis for further strict scrutiny of the scheme which is presented in this report.

In this study, it has been clarified that the properties of swamp areas in Trengganu and its utility for agricultural development. We classified whole swamp areas of 129 thousand ares, in which 72.6 thousand acres can be utilized for the integrated agricultural development covering paddy, upland crops, livestock rearing, fisheries and sericulture. On the other hand, the economic internal rate of return (EIRR) is estimated to be 14 to 17 percent for each work-unit.

It is therefore our earnest hope that the project will be put forward to the next step for execution at the earliest possible date.

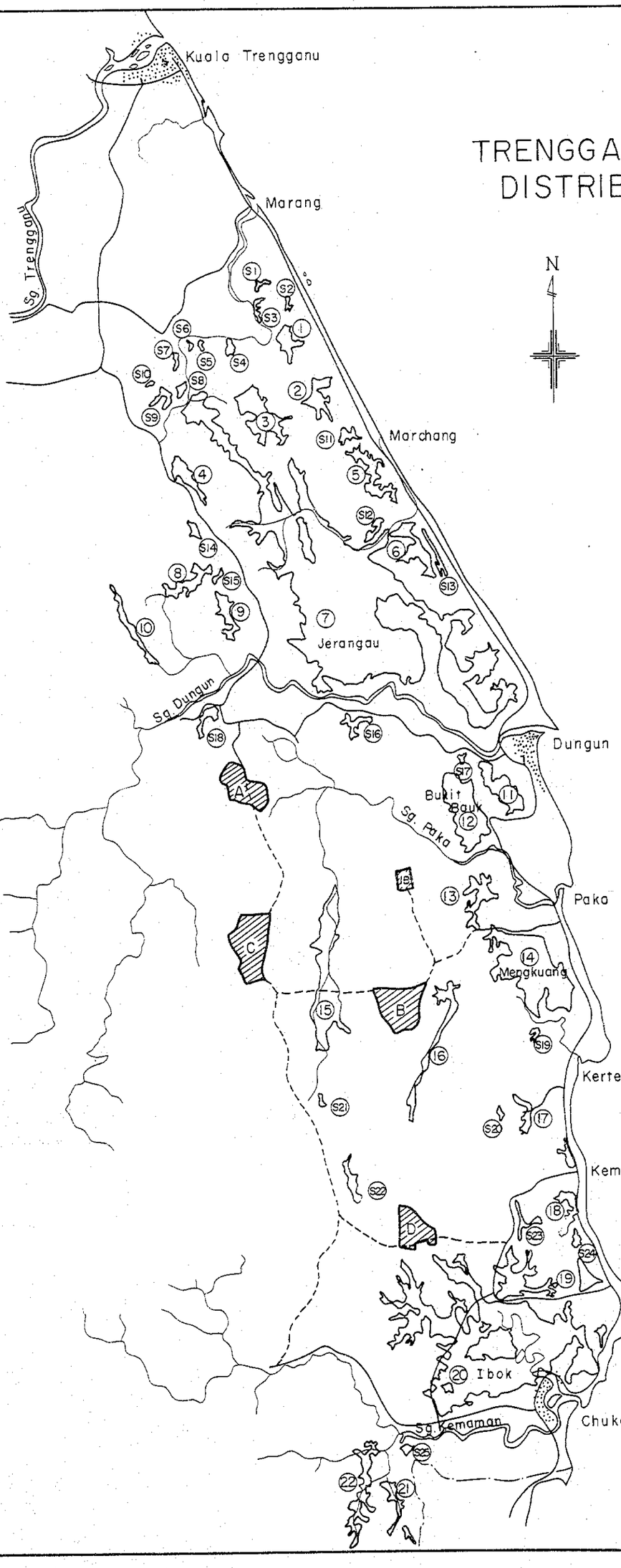
On this occasion, we wish to express our deepest gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Fisheries, the Advisory Group, Embassy of Japan, and the Malaysian Government for the most helpful and valuable assistance extended to the team throughout the field survey and home office work.

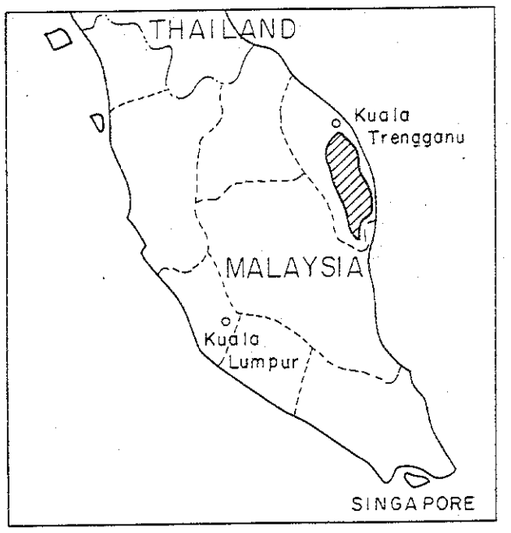
Very truly yours,

Y. Mochizuki

Yoshizo Mochizuki
Leader
Master Plan Study Team for the
Trengganu Swamp Area Integrated
Agricultural Development Project

TRENGGANU SWAMP DISTRIBUTION MAP





LEGEND

①	SWAMP
———	EXISTING ROAD
- - - -	NEW HIGH WAY
A	KETENGAH NEW TOWN
—·—·—	STATE BOUNDARY

Scale Approximately 1 : 320.000

0 10 20km

S U M M A R Y

Antecedents

1. The study was conducted for the purpose of preparing a master plan to utilize swamps in Trengganu, Malaysia, for agricultural development, to settle families below poverty line within the state for increased income and well-being, and further to spur the economic growth of the entire state through the promotion of agriculture.

2. In 1977, the Malaysian Government requested the Japanese Government to conduct swamp surveys and work out an agricultural development plan. In response to the request, the Japanese Government despatched a preliminary survey team to Malaysia during the period of February to March, 1978, to discuss the ways of surveys and planning with the Malaysian Government. In accordance with the agreement between the Economic Planning Unit of the Malaysian Prime Minister's Department and the Japan International Cooperation Agency, the Feasibility Study Team was dispatched from August to November, 1978, in order to reconnoiter the Bukit Bauk, one of the swamp areas, and make up its development plan the pilot project.

3. In accordance with the agreement mentioned above, the Master Plan Study Team stayed in Malaysia from June to September, 1979, for the purpose of a fact-finding survey of the swamps extending from the south of the Trengganu River and for basic surveys on agricultural development. The report submitted herewith is a master plan on the integrated agricultural development in Trengganu formulated by the Study Team after detailed studies based on the field surveys.

Background

4. Malaysia is divided into 13 stages - 11 in Peninsular Malaysia and 2 of Sabah and Sarawak in Borneo. According to the statistics in 1978, Peninsular Malaysia has an area of 50,806 square miles, a population of 10,840,000 and per capita gross domestic product (GDP) of M$1,676 nearly equivalent to US$754. Malaysia is a nation employing a federal system, and the development usually is undertaken by each independent state. Of the 11 states in Peninsular Malaysia, Trengganu is among the most retarded. Trengganu has an area of 5,050 square miles (9.9% of the Peninsular Malaysia), a population of 495,000 (4.6%), and a per capita GDP of M$1,005.

5. In Malaysia, agriculture accounts for 24.8% of GDP far above all other industrial sectors. Malaysia is an agricultural country having internationally monopolized commodities such as rubber, palm oil and pepper. However, the annual growth of agricultural production is very low with a mere 4.8%, the lowest against an average 8.7% of all industries. Nevertheless, this does not preclude agriculture from being the main stay of the country. Of the total population of 495,000 Trengganu has, 49% are accounted for by farmers, of which more than 80% are likely to come from families below the poverty line. While the State Government has been pushing forward the improvement of agricultural structure and the new farmland development to eradicate poverty, it is forecast that even when all the government projects in the stage of planning and on-going are completed, 40,000 farmers will have yet to be settled.

6. Malaysia has a large poor population, but has no population on the starvation line. The agricultural policies in Malaysia are therefore intended for the creation of employment opportunities, and not for securing foodstuffs. Traditionally, Malaysia has been known for its international agricultural products, and the present project should center on similar products with a high realizability and marketability. It should be mentioned with all emphasis that the agricultural policies in Malaysia must be designed to save farmers from poverty while improving the quality of products as the food market has changed from quantity to quality, and has caused agriculture in Malaysia to enter into a tricky stage.

7. Against this background, the swamp area agricultural development has emerged as an epochal comprehensive project covering livestock rearing, freshwater pisciculture and sericulture for the purpose of creating employment opportunities in Trengganu.

Swamps and land use

8. The swamps are classified into two types of inland swamps and three types of coastal swamps, namely the inland swamps are subclassified into water-logged type and seasonal type, and the coastal swamps into mangrove type, sand-dune type, and tide-influenced (tidal) type. Apart from these classifications, the swamps are also classified into large type (measuring about 700 acres or more) and small type (measuring up to about 700 acres) for the convenience of study.

9. The inland swamps are water-logged. This is because underground seepage and evapotranspiration are extremely small as compared with the supply of water by rainfall and flooding. If proper drainage system is provided, almost every swamp can be turned into formland.

10. The swamp soils can roughly be divided into organic one mainly composed of peat soil and black muck, and inorganic one containing chiefly recent riverine and marine deposits. The host rock for the latter is chiefly of the Palaezoic Era or the Mesozoic Era. In any case, the soils are destitute of bases, and show a low base saturation; they are highly acid and lack of fertility. The same characteristics are found in the soils of terraces surrounding the swamps. What makes the soils of terraces different from those of the swamps most is that the swamp soils have been produced under highly reductive conditions.

11. It was identified by the field survey that some 70 species of trees were in the swamp forests. But the commercially valuable species were rare both in quantity and quality. Of the useful species, Terentang, which is most suitable for splints, was conspicuous and formed pure stands in most places.

12. It is technically feasible to develop and utilize any type of swamp in Trengganu for agricultural use. But, the mangrove swamp in Trengganu for agricultural use. But, coastal dikes, gates, drainage pumps and similar large-scale works, the cost of which is prohibitive, and are precluded from the project. The water-logged swamps and tidal swamps which necessitate large-scale embankment work will also be excluded.

13. According to the surveys, the swamps have a total area of 129,150 acres, of which 79,610 acres are selected for the development.

14. Of the projected development area, 58,083 acres will be turned into farmland consisting of 10,690 acres of paddy fields, 31,740 acres of upland fields, 6,300 acres of mulberry fields, 8,550 acres of grassland and 800 acres of fishponds. The proposed families to be settled will amount to 11,157.

Present state and prospective agriculture

15. Target income: The Malaysian Government has put forward the relief of people below poverty line ahead of all socio-economic policies. The poverty line seems to be M$250 to M$300/household/month, though it varies from state to state and year by year. In the master plan, the target net annual income per household is set at about M$6,000.

16. Paddy farming: The staple food for the Malaysians is rice. In Peninsular Malaysia, there are paddy fields of 920,000 acres of which 57% or 527,000 acres are implemented with irrigation facilities for double cropping due greatly to MUDA Scheme in Kedah and Perlis, and KADA Scheme in Kelantan. In other areas, paddy fields implemented with irrigation facilities are less. In Trengganu, there are paddy fields of about 13,000 acres of which about 10% alone are furnished with irrigation facilities. It is estimated that the self-sufficiency rate of rice is well over 80%, and that it could be increased to more than 90% when the double cropping patterns is popularized. In the future, the unit yield per acre of paddy will be increased, and some part of the paddy fields might be converted into upland fields. Most of farmers working on paddy fields make out their livelihood on a petty income, and 80% of them are on the poverty line.

17. According to the master plan, the paddy fields will be developed at places that are not suitable for crops other than paddy and that are near rivers, and places that will not receive a great deal of floodwater. The paddy fields will be implemented with irrigation facilities for double cropping. The labor productivity in paddy farming is low, and the farmers must diversify their business by combining paddy farming with upland farming or freshwater pisciculture as the paddy farming alone will not be enough to achieve the target net income. The total acreage of paddy fields will be 10,690 acres, and each farm unit will have 150 acres. The farmland per household will be 4.0 acres of paddy fields and 1.0 acre of fishponds, or 3.5 acres of paddy and 1.5 acres of upland fields. The remaining households mainly engaged in paddy farming will amount to 2,940.

18. Upland farming: In Malaysia, the main upland crops are rubber and palm oil. The upland fields amount to about 6,210,000 acres of which 4,190,000 acres (67.5%) are accounted for by rubber plants and 1,080,000 acres by oil palm, these two accounting for 85% of the total area. Acreages of coconut palm are 8.7% or 540,000 acres, and other crops are harvested from a mere 6.4% or 400,000 acres. The poverty ratios of upland field households are 59% in the rubber sector, 50% in the coconut palm sector and only 9% in the oil palm sector. This is because the rubber growers are mostly small scale farmers with 2 acres or so while oil palm growers are operating on a comparatively large scale with 10 acres in recently developed areas.

19. In the master plan area, the total acreage of upland fields is set at 31,743 acres, and the acreage of farm unit at 180 acres. The farmland per household will be 6.0 acres. The full-time upland farming households will amount to 4,747.

20. The proposed crops should not be limited to cash ones, and will be determined with due consideration given to annual distribution of labor, marketability and crop rotation for prevention of overcropping hazards. Pepper, tomato, tobacco, vegetables, maize, pineapple, sorghum, groundnut, cassave, etc. will be included.

21. Livestock rearing: In Malaysia, livestock rearing is far behindhand compared with other agricultural sectors. In Peninsular Malaysia, main livestock includes 204,000 of water buffaloes, 363,000 of beef cattle, 310,000 of goats, 43,000 of sheep, and 790,000 of fowls. There are no rearing facilities to speak of; water buffaloes and beef cattle are turned out to wild grasslands near the roads or paddy fields after harvest. Therefore, the rearing period is rather long, and the meat productivity is low. In recent years, the Federal Veterinary Department has developed grazing reserves which are now open to nearby farmers for grass gathering or grazing. In Trengganu, the newly developed grassland is only 1,200 acres, and it is hoped that the Department will develop more in the future. At any rate, the livestock rearing as represented by beef cattle and milk cow is one of the sectors in which the Malaysian Government is most interested.

22. In the livestock rearing plan, the feeding-out of beef cattle on developed grassland and rearing of milk cows for about thirty-six months from the time they are about six months old to the stage immediate before calving will be carried out. The grasslands will be classified into two types: one Napier is grass for cutting and moving and Guinea grass for grazing. The operating scale will be 9.0 acres of grassland and twenty livestock units of cattle (34 heads) per household. The total planned area of grassland will be 8,550 acres, and the total number of livestock will be 19,000. The livestock rearing households will amount to 950.

23. Freshwater pisciculture: It is estimated that Malaysia has fishponds of 11,900 acres with an annual output of 8,900 tons. Most of the fishponds are seen along the west coast of Peninsular Malaysia. There are also fishponds in Trengganu which amount to about 70 acres, but the marketing and pricing of freshwater fish is not so stable as of marine fish. Statistical data are also meager. In the monsoon period, the fishermen living along the East Coast are checked from going out to the South China Sea, and the State Government of Trengganu has been pushing forward freshwater pisciculture for stabilized supply of fish. At present, however, freshwater pisciculture still remains in an initial stage relying on peddling fishmongers for distribution.

24. According to the master plan, the total area of fishponds will be set at 800 acres in consideration of distribution capacity of fish markets in Trengganu. The freshwater pisciculture is a sector with bright prospects, but presently its market is not stable enough. This sector leaves much to be desired in infrastructure such as the supply of fry and feedstuffs. In addition, the fish culture causes seasonal maldistribution of labor. It will therefore be premature to foster full-time fishermen, and the fish farming should be combined with paddy farming. The proposed fish might be limited to Lampan Jawa, Chinese carp and other common carps which will be popular in Trengganu in the early stage of the project.

25. Sericulture: So long as sericulture is concerned, Malaysia falls far behind the neigboring countries such as Thailand and Indonesia. The State Agricultural Department started an experiment on mulberry farming and silkworm rearing in Trengganu for the first time in 1972. Namely, the seventy-nine sericultural farming households working on seventy-three acres of mulberry farms in Trengganu are all that Malaysia has. In anticipation of the growth of silk demand, the Malaysian Government has given the highest priority to sericulture.

26. The demand for raw silk and silk products is stagnant all over the world, however. Nevertheless, the demand in Malaysia is expected to grow in the future. In Malaysia, there are unique folk crafts such as batik and songket, and domestic silk will be applied to them without counting on foreign sources. The silk products will be consumed within Malaysia alone, and advancement to international markets will be the last thing to be considered.

27. The sericulture is quite a new experience in Malaysia, and its starting operations will be limited to the extent that one filature will be enough. The filature will be equipped with thirty-five sets of automatic reels. When the project is completed, the mulberry farms will be 6,300 acres; annual output of cocoons will be 1,780 tons; the annual output of raw silk will be 300 tons; the silkworm eggs gathered will amount to 71,200 cases; and the total number of sericultural farming households will be 2,520. Each sericultural farming household will operate 2.5 acres of mulberry farms, turning out 25 cases of silkworm eggs and 75 kg of cocoons a year.

Work volume and project costs

28. The project implementation will be carried out in 13 years, including detailed design. The proposed swamps will be divided into three. The outline is shown as below.

Swamp	Farmland	Arterial Drain	Arterial Road	Project Cost	Cost per Acre
	(acre)	(km)	(km)	(M$ '000)	(M$)
1) Jerangau	48,390	129.2	155.5	303,127	6,264
2) Mengkuang	13,155	21.3	30.8	102,622	7,800
3) Ibok	11,059	19.5	22.7	82,042	7,418
Sub-total	72,604	170.0	209.0	487,791	6,718
Filature				27,690	
Total	72,604	170.0	209.0	515,481	7,099

Economic justification and financial analysis

29. The investment in the master plan area is justifiable in terms of the net value that will be added to the national economy, the benefits to farm families and other socio-economic benefits. The economic costs of the master plan are estimated at M$338,917 thousand summing up M$227,223 thousand for the Work Unit No. 1, M$63,100 thousand for the Work Unit No. 2 and M$48,594 thousand for the Work Unit No. 3 at October 1979 prices in which allowance for price escalation is not included. The major tangible benefits to evolve from the project will be a substantial paddy, upland crop, livestock, sericultural and freshwater piscicultural production, and the resulting income and employment opportunities for about 40,000 farmers.

30. On the basis of the economic costs and the direct tangible economic benefits from crop production, freshwater pisciculture, livestock rearing and sericulture, the economic internal rate of return (EIRR) for the Work Unit No. 1, the Work Unit No. 2 and the Work Unit No. 3 of the project has been calculated at 14.0%, 14.8% and 16.7%, respectively. Sensitivity tests conducted for a variety of circumstances show that the project would be still economically justifiable.

31. Income to farm households includes the net value of crops produced and off-farm income from paddy processing, livestock rearing, sericulture, etc. By utilizing irrigation and drainage facilities efficiently, combined with improved farming practices, a settlers managing 5 acres of paddy farms including upland crop farming on an average will be able to create a gross farm return of M$10,810 per annum even if the return is limited to that farm crop production only. On the other hand, it is expected that most of upland crop farming settlers managing 6 acres of upland crop farms will create a gross farm return of about M$11,000 per annum on an average.

CONCLUSIONS AND RECOMMENDATIONS

1. Despite their rich agricultural potential, the swamps have so far been ignored. People have only rejected the swamps without study as useless, alleging that those are inadequate in locations and soil conditions. The survey results indicate that the majority of the swamps could be used satisfactorily for agricultural purposes if proper development methods were employed. We admire the pioneering spirit of those who projected the exploitation of the vast tract of swamps for long-term agricultural development in Peninsular Malaysia. It can be said with all emphasis that the Trengganu Swamp Area Integrated Agricultural Development Project will do much toward the husbandry of land resources in Trengganu, and at the same time serve a major spur to the modernization of agriculture in Malaysia and the development of tropical swamps in other Malaysian states and in other countries.

2. The Master Plan Study was conducted to cover all the swamps south of the Trengganu river or 129,000 acres. Of them, developable swamps are 79,610 acres, and the total project cost will reach M$489.8 million, or M$6,718/per acre, which is higher than that of agricultural developments in upland area. The swamps are spread over a flat terrain, and this good location, together with other various factors, will offset the high costs of the project. The project is a new development with high benefit potentials, and is justifiable from the economic viewpoint. It is therefore hoped that the Malaysian Government scrutinizes this master plan and takes the necessary steps for promoting the implementation of the project.

COUNTRY DATA, 1979

AREA: Malaysia 127,581 square miles (Peninsular Malaysia 50,806; Sarawak 48,050; Sabah 28,725)

POPULATION

Malaysia (Peninsular Malaysia 11.05 m, Sarawak 1.22 m, Sabah 0.98 m)	13,250 million
Peninsular Malaysia (Malays 5.97 m, Chinese 3.85 m, Indians 1.15 m, Others 0.08 m)	11.050 million
Average growth rate, Malaysia 1976–80 (% per annum)	2.7%

NATIONAL PRODUCT (constant 1970 prices)	% growth	% share
Gross National Product ($23,264 million)	8.0	100
Consumption expenditure: Public	12.2	19
Private	10.5	59
Fixed capital formation: Public	22.3	11
Private	11.5	15
Exports of goods and services	5.2	42
Imports of goods and services	15.0	43
Per capita income, of GDP at current prices ($3,205)		

DOMESTIC PRODUCT (constant 1970 prices)	% growth	% share
Gross Domestic Product ($24,084 million)	8.1	100
Agriculture (Rubber 9%, Palm Oil 7% of GDP)	5.6	24
Manufacturing	12.0	20
Construction	14.0	4
Wholesale and retail trade	7.0	13
Banking, insurance, real estate and business services	5.0	8
Producer of government services (public administration, defence, health, education)	7.6	12

FEDERAL GOVERNMENT FINANCE

Revenue	$10,220 million
Operating expenditure	$ 9,910 million
Current account	$+ 310 million
Development expenditure	$ 4,600 million
Overall deficit	$–4,290 million

BALANCE OF PAYMENTS AND RESERVES (net)

Current account	$+ 450 million
Capital account	$+2,770 million
Basic balance	$+3,220 million
Net external reserves	$ 8,714 million
Change in net external reserves	$+1,350 million

INTERNATIONAL TRADE	$ million	Annual % growth
Total exports (Rubber 21%, Petroleum crude 18%, Tin 11%, Palm Oil 11%, Sawlogs 9%, Manufactures 20%, of total exports)	21,025	23.0
Total imports (Food 15%, Manufactures 21%, Mineral fuels 13%, Machinery and transport equipment 36%, of total imports)	16,505	20.6
Trade balance	4,520	

MONEY AND BANKING	$ million	Annual % growth
Money supply	8,543	18.0
Quasi money	12,678	23.4
Private sector liquidity	21,221	21.1

Commercial banks' prime lending rate (7½% per annum at end August)
One Malaysian Ringgit = 0.356 SDRs, US$0.46, £0.20 (end August)
(Before Ringgit was floated on June 20, 1973, one Malaysian Ringgit = US$0.40, £0.16)

PRICES		Annual % growth
Commodities: Rubber RSS 1 f.o.b. Kuala Lumpur (cents per kilogramme)	275	19.6
Tin f.o.b. Penang ($ per picul)	1,850	6.1
Palm oil crude, c.i.f. N.W. Europe ($ per tonne)	1,460	3.2
Petroleum crude, average export price (US$ per barrel)	20.40	43.4
Consumer Price Index, 1967 = 100 (Peninsular Malaysia)	170.5	5.0
of which, Food (weight = 46.8%)	184.8	4.0
Export Price Index, 1970 = 100 (Peninsular Malaysia)	232.3	16.5
Import Price Index, 1970 = 100	228.9	10.0

EMPLOYMENT

Total labour force ('000)	4,956
Employed (Agriculture 43%, Manufacturing 14%, Government 14%)	4,658
Unemployed	298
Unemployment rate (% of labour force)	6.0%

(Source: Economic Report, 1979/80 prepared by Ministry of Finance, Malaysia, 1979)

C O N T E N T S

VI. PLAN OF AGRICULTURAL PRODUCTION

Attached:

List of Tables and Figures

ABBREVIATIONS AND DEFINITION OF TERMS

km	kilometer	%	percent
m	meter	L	length
cm	centimeter	Q	quantity
mm	millimeter	ø	diameter
ft	foot	H	head
t	ton	MW	million watt
kg	kilogram	N	nitrogen
g	gram	P	Phosphorous
km^2	square kilometer	K	Potassium
m^2	square meter	wt	weight
m^3	cubic meter	Fig.	figure
ha	hectare	U.S.$	U.S. Dollar
$mile^2$	square mile	M$	Malaysian Dollar
kl	kiloliter	M$/ha	Malaysian Dollar per hectare
l	liter	U.S.$/ha	U.S. Dollar per hectare
m^3/sec	cubic meter per second	M$$10^3$	M$1,000
l/sec	liter per second	U.S.$$10^3$	U.S.$1,000
l/ha	liter per hectare	M$/kati	Malaysian Dollar per kati
l/sec/ha	liter per second per hectare	EIRR	Economic Internal Rate of Return
inch/month	inch per month	GDP	Gross Domestic Product
ft^3/sec	cubic feet per second	GNP	Gross National Product
t/ha	ton per hectare	c.i.f.	cost, insurance and freight
kg/ha	kilogram per hectare	f o b	free on board
t/hr	ton per hour	TOL	Temporary Occupation License
hr(s)	hour(s)	DBH	Diameter at Breast Height
mm/day	millimeter per day		
°C	degree centigrade		
°F	degree Fahrenheit		
lbs	pounds		
kt	kati		

IBRD	International Bank for Reconstruction and Developme
FAO	Food and Agriculture Organization of the United Nations
KETENGAH	Trengganu Tengah Development Authority
EPU	*Economic Planning Unit*
MARDI	Malaysian Agricultural Research and Development Institute
DID	Drainage and Irrigation Department
FAMA	Federal Agricultural Marketing Authority
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FELDA	Federal Land Development Authority
MAJUIKAN	Fisheries Development Authority of Malaysia
RISDA	Rubber Industry Smallholders Development Authority
SEDC	State Economic Development Cooperation
DAU	Development Administration Unit
GPU	General Planning Unit
NDPC	National Development Planning Committee
CIC	Capital Investment Committee
PSD	Public Service Department
JKR	Public Work Department
LPN	National Paddy and Rice Authority
PRMB	Paddy and Rice Marketing Board
BPM	Bank of Agriculture Malaysia
MARDEC	Malaysian Rubber Development Corporation
RRIM	Rubber Research Institute of Malaysia
FRI	Forestry Research Institute
MRRDB	Malaysian Rubber Research and Development Board

SIRIM	Standard and Industrial Institute of Malaysia
MAJUTERNAK	National Livestock Development Authority
MIDA	Malaysian Industrial Development Authority
UDA	Urban Development Authority
KADA	Kemubu Agricultural Development Authority
MUDA	Muda Agricultural Development Authority
U.K	United Kingdom
NEP	New Economic Policy (1970)
FMP	First Malaysia Plan (1966-1970)
SMP	Second Malaysia Plan (1971-1975)
TMP	Third Malaysia Plan (1976-1980)
MTR	Mid-Term Review

CONVERSION TABLE OF MEASURES

(1) Gantang = 1 Imperial gallon = 4.546 l or
= 2.54 kg

(2) Kati = 1.33 pounds = 0.606 kg

(3) Picul = 133 pounds = 60.55 kg

CURRENT EQUIVALENT

M$1.00 = US$0.45

I. INTRODUCTION

I-1 Purpose of the Study

1. The Master Plan Study for Trengganu Swamp Area Integrated Agricultural Development in Malaysia purposes to formulate a basic framework for turning the swamps in Trengganu into good farmland where the people below the poverty line can be settled for stabilized livelihood and increased income through agriculture including livestock rearing, freshwater pisciculture and sericulture, and also for the development of the state economy with the agricultural promotion.

I-2 Antecedents

2. The background to the study for the preparation of this master plan is as follows:

(1) Malaysia is recognized as a semi-developed country in Southeast Asia, and is stable both politically and economically. But it is multinational, consisting of Malay, Chinese, Indian, etc., and 63% of the people lead a life below the proverty line for want of employment opportunities and income. Malaysia has many other problems.

(2) The New Economic Policy formulated in 1970 to see far into 1990 underlies the economy in Malaysia. The working policies are shaped in the form of mid-term economic plans. At present the Third Malaysia Plan (TMP: 1976-80) is half over.

The TMP is committed to the expansion of employment opportunities, eradication of poverty, economic balance between communities, and the improvement of social structure. The first two are the policies for which the Malaysian Government is endeavoring the most, and the government authorities have been pushing forward various development programs along these policies.

(3) Trengganu has a population a little short of 500,000, of which 49% are engaged in agriculture, and it is estimated that the greater part of the farming population is on the poverty line. Even when the on-going projects, including the Trengganu Tengah Development, and other projects for the state are completed, there still will remain 40,000 applicants for settlement unredeemed.

In view of this, the Malaysian Government felt the urgent need to further the agricultural development within the state for relieving the people below the poverty line through agriculture.

(4) Against this background, the Trengganu Tengah Development Authority (KETENGAH) was established as a government agency on a mission of socio-economic development within the state. Its jurisdictional coverage is about one third of Trengganu in the south, or 1,090,000 acres. The works by KETENGAH have been pushed forward in full swing, and the land use plan has already been finalized.

(5) The plans that KETENGAH is now implementing were made up by the Hunting Technical Services, a consulting corporation of the U.K. The plans in those days were shelved up for reasons of high development costs and low land productivity of the swamps.

(6) As it became harder and harder to find land for large-scale agricultural development, the state government came to think better of the utilization of swamps for the purpose of helping the 40,000 applicants for settlement. It is reported that Peninsular Malaysia has swamps amounting to 2,000,000 acres, and the plan for swamp exploitation attracted the attention of many people who observed it would bring about a great impact on other states.

As there is no precedented case of large-scale swamp development, the Malaysian Government decided upon the execution of a master plan study for the purpose of clearing up the facts about swamps and studying the development methods and the relationships between the development and the economy of the state.

(7) A visit of the then Prime Minister Fukuda to Malaysia in 1977 paved a way for economic cooperation between Malaysia and Japan, and the Malaysian Government requested Japan to extend a technical assistance in agricultural development in swamps as a form of such cooperation.

KETENGAH requested Japan for formulation of a master plan for all the swamps and execution of a pilot project at a selected site as early as possible.

(8) The following policies were confirmed and agreed upon as a result of a series of discussions between the Japanese Preliminary Study Team and the competent Malaysian authorities.

a) The scope of study for the master plan preparation will cover classification of the swamps within the KETENGAH's territory from the viewpoint of land use capability, comparison of alternative land use methods, review of swamp development method, clarification of the development impact on the state's economy, and coordination of the swamp development project, neighbouring communities, and existing development projects. The study will be completed in 1979 in order that areas to be developed in accordance with the master plan will be enrolled in the Fourth Malaysia Plan.

b) A fesibility study for the pilot project will be executed in 1978. The pilot project will be a case study to be conducted prior to the study for master plan preparation in order to check the validity of the swamp area development method itself. It is necessary that the pilot project be initiated as soon as possible in order to assure that the technical data derived from its execution will be applied for the master plan area. For this purpose, it will be included in the mid-term review of TMP in 1978, and the feasibility study will be completed in 1978.

c) Areas selected as a result of the above master plan study will be undertaken by KETENGAH at a future date, however, for the present development of such areas will be implemented in a separate plan.

This is the background in which the master plan study on Trengganu Swamp Area Integrated Agricultural Development was carried out.

I-3 Scope of the Study

3. The scope of the master plan study and its particulars are as follows.

(1) Survey on distribution of swamps to cover all the swamps laying south of the right bank of the Trengganu River.

(2) Socio-economic survey to cover the entire State of Trengganu.

(3) Soil survey to cover inland swamps south of the right bank of the Trengganu River.

(4) Basic survey for development technology to make the best use of the existing data, such as soil maps and topographic maps, available chiefly from KETENGAH.

(5) Field work

i) Reconnaissance for fact-finding in the planned area.

ii) Collection of supplementary data and information.

iii) Soil, geological and hydrological surveys.

iv) Surveys for planning irrigation, drainage and water management.

v) Agricultural survey.

vi) Agricultural economic survey.

vii) Socio-economic survey.

viii) Forestry survey.

ix) Livestock industry survey.

x) Piscicultural survey (freshwater pisciculture)

(6) Home work

a) Long-term projection of population, demand and supply situation of food, agricultural patterns, types and outputs of agricultural crops and market formation with Trengganu viewed as an economy.

b) Selection of adaptable crops according to the classification of soils in swamps and the results of soil survey.

c) Feasibility study of drainage work for each swamp according to hydrological analysis, and formulation of viable methods for drainage.

d) Analysis of socio-economic status of each swamp.

e) Estimate of project cost for each type of swamp.

f) Composite rating of each swamp according to the results of (a) through (f) above for determination of the development priority.

g) Preparation of a model farm management plan to help KETENGAH which sets the future of agricultural development.

h) Preparation of a master plan including below items according to the results of (a) through (g) above.

i) Formulation of comprehensive development plan.

ii) Estimate of project costs and benefits.

iii) Economic evaluation and study of financial plans.

iv) Formulation of plan for management and operations.

I-4 Acknowledgements

4. Grateful recognition is made for the cooperation and assistance during the field survey, the collection of data and information, and the execution of the survey provided for the survey team by officials of the Malaysian Government, the State Government of Trengganu, the Trengganu Tengah Development Authority, other governmental authorities concerned, and private organizations and individuals. Thanks are due to all of them.

II. BACKGROUND

II-1 Economic Trends

5. Malaysia was once a colony of the United Kingdom, and was dominated by a monocultural economy centering on rubber and tin until as late as the early 1960s, not to speak of the time when the United Kingdom was the suzerain. Although Malaysia has been promoting industrialization since the latter half of the 1960s, its economy is still heavily dependent on the export of primary products because of its tardy progress in industrialization.

6. According to the Third Malaysia Plan (TMP) covering the period from 1976 to 1980, the Malaysian Government has been stepping up its efforts to promote commerce and industry and eradicate poverty. In the MTR of the TMP, it is reported that the ratio of the primary industries (agriculture and forestry) to the domestic gross product (real GDP) in 1978 remained at 25.2%, but the ratio of primary products including processed goods of raw materials to exports was as high as above 80%.

7. This heavy dependence of the Malaysian economy on the exports of primary goods is a disadvantage in that it is easily susceptible to the economies of the countries which import from Malaysia. A plunge of demand from the advanced countries due to a world-wide depression triggered by the first Oil Crisis in 1973 told hard upon the Malaysian economy.

8. The First Malaysia Plan (FMP) (1966-70) and the Second Malaysia Plan (SMP) (1971-75) stepped up the ratio of industrialization to 10.4% and 14.3%, respectively, thanks to the processing of primary products and replacement of theretofore imported goods with homemade consumables and intermediate products, but the industrialization is far from the development of heavy industry and chemical industry.

9. Taken altogether, however, the Malaysian economy has been moving favorably in recent years. During the life of the SMP, the annual average real GDP eventually grew to be 7.4% as against a planned value of 6.9%. Although the economic growth in the 1977-78 period was a bit lower than than the target value of 8.5% declared in the TMP, it remains, none the less, an excellent mark considering that the economic growth of the major advanced countries were on or below a 5% level in the corresponding period. The economic growth

rate for the period from 1976 to 1980 has been revised from the original 8.3% to 8.4%, reflecting the firm tone prevailing in the Malaysian economy.

10. While the Malaysian economy is moving nowhere but up with the current financial balance in the black, it shows a heavy deficit if the development balance is considered. The financial deficits have been snow-balling year after year; the deficits amounted to M$3,480 million in 1978 and are expected to reach M$3,609 million in 1979. The deficits are covered by loans from domestic and foreign institutions. Since 1975, measures for monetary ease have been taken for the purpose of stimulating private investments necessary for the achievement of the TMP goals.

II-2 Economic Development Plan

11. Malaysia became independent in 1957, and the First and Second Malaya Plans in the pre-independence days were taken over by the newly formulated FMP (1966-70). Prior to the formulation of the FMP, a long-term plan covering two decades from 1965 to 1985 was worked out for purposes including the increase of the per capita income to M$1,500 (based on the 1965 prices) and reduction of the annual rate of population growth from 3% to 2%. This long-term plan is still alive as a guiding principle in the formulation of the succeeding Malaysia Plans.

12. Played up in the FMP were the improvement of agricultural productivity, buildup of market competitiveness of rubber and other international commodities, and encouragement of home production through introduction of foreign capital in order to replace imports with home products. Creation of employment opportunities and correction of regional and racial differences were also taken up as important subjects which set the FMP quite different from the previous Malaya Plans. When the annual economic growth rate marked 5.9% on the average during the life of the FMP as against a target value of 4.8%, the racial difference widened, and the reduction of unemployment ratio betrayed expectations.

13. In 1970, the Malaysian Government announced the New Economic Policy (1970-90), which was mapped out based on the review of the FMP. Then, the Second Malaysia Plan (SMP) was formulated following the New Economic Policy. In the SMP, emphasis was placed on the expansion of employment opportunities and enhancement of the standard of national living in order to achieve the goals set in the New Economic Policy.

14. Now, the Malaysian economy is revolving around the Third Malaysia Plan (TMP) in which great importance is attached to the promotion of commerce and industry by private businesses and not by government, measures against poverty through the development of farmland, and tight security control against communication. The TMP was subjected to a mid-term review (MTR) toward the end of 1978, and the budgetary reallocation was carried out for the purpose of achieving its goals.

15. In the 1979-80 period, which falls on the latter half of the TMP, the TMP will be pushed forward according to the MTR. It is said that the success or failure of the TMP economically hinges on the adaptation to international economic circumstance and the raising of funds necessary for development. The idea of the Master Plan Study of the Trengganu Swamp Area Integrated Agricultural Development Project may have burgeoned in these economic development plans.

16. Thus, it was decided upon, in appreciation of these policies that poverty be eradicated through the development of farmland and that the Peninsula, particularly the swamps along the East Coast, be developed for settlement of the people below the poverty line and the State of Trengganu was nominated as the first example for its high development potentiality and accessibility.

II-3 Economy in Trengganu State

17. Trengganu is a state on the East Coast of the Peninsula, and has an area of 5,050 square miles. The population as of 1978 was reported to be 495,000. About 70% of the area is covered with forests, and the cropland is only 464,000 acres, or about 14%. Up until recently, the industry has been led by agriculture and forestry and nothing else.

18. Of late oil was struck off the coast, and a 400,000 kW hydroelectric power station, one of the largest in Malaysia, was constructed in the upper reaches of the Trengganu, the largest river in the state, making a major step toward industrialization.

19. According to the MTR of the TMP, the State of Trengganu, which is at the bottom of the ways and means list of the eleven states in the Peninsula, is found to have made marked economic progress by virtue of KETENGAH's farmland development which has been pushed on since early 1970s and also on the strength of oil extraction and construction works. GDP was increased from M$357.8 million in 1975 to M$528.9 million in 1978 (both in terms of 1970 prices),

marking a sizable increase of about 150%. On the other hand, the per capita income soared from M$737.7 to M$1,005.5.

20. The ratio of agriculture and forestry to GDP was 47.8% in 1975, but was reduced to 42.2% in 1978. On the other hand, the mining and quarrying which accounted for a mere 1.8% in 1975 shot up to 10.9% in 1978. The manufacturing sector also increased from 6.5% to 7.6%. The mining, quarrying and manufacturing industries are expected to progress steadily. Agriculture and forestry have remained stagnant for some time now, but will continue to have good prospects for the state because of its magnitude in the entire industry and in the state economy.

III. SIGNIFICANCE AND PARTICULARITIES OF SWAMP DEVELOPMENT

III-1 Particularities of Master Plan for Swamp Development

21. The study is named "Master Plan Study for Trengganu Swamp Area Integrated Agricultural Development". The scope of the study is to examine the actual state of the swamps within the central and southern parts of the Trengganu State and to study the feasibility of turning them into areas for agricultural development. The swamp area sited for development measured about 126,000 acres, and is not so large, but has the following particularities.

i) The study is a systematically conducted technical study for the tropical swamps. Tropical swamps are distributed in Malaysia and in many other countries, but there has been only a few reporting the studies concerning their investigation and exploitation. The Hunting Technical Services, England, which formulated the Trengganu Tengah Plan, left the swamps out of the Plan without so much as taking a look at them, taking them for being too costly and low in productivity to develop. On the contrary, to investigate the tropical swamps is very meaningful not only for Malaysia itself, but internationally, because its results can be used for the development of tropical swamps.

ii) In Trengganu, the supply and demand of food is balanced, and there are no people living close to the margin of starvation. But, the demand-supply situation referred to above is tolerable only on a low living standard, and it is certain that the people will come to demand improvement of the food situation in both quantity and quality with the development of the social environment. One of the objectives of the swamp development is the homesteading of those families who are below the poverty line, and not simply the increasing of food production.

The agricultural produce expected to be turned out by the swamp development should be studied in terms of the relations in quality and quantity with the existing agricultural system, the supply and demand relations in the state and in the country as a whole, and more largely of the possibilities of export to the neighboring countries.

iii) The swamps under the development project amount to about 50, large and small, and are distributed over a large expanse of land. Though the developments of swamps is local, it cannot stand clear of the existing communities around which such swamps are present. Namely, the development project must take all these communities into account, and thus cover the entire state.

22. All these are particularities of swamp development and constitute a reason for the necessity of the master plan.

III-2 Definitions and Classification of Swamps

(1) Definitions

23. The swamps have not yet been defined or classified scientifically. In the master plan study, a swamp is defined as a terrain, part or the majority of which forms a primeval forest or a wilderness, and which is water-logged for a considerably long period of the year. The swamp is roughly classified into the following two types.

i) Coastal swamp or tidal swamp
ii) Inland swamp or freshwater swamp

24. The coastal swamp refers to one which is now under the influence of seawater or whose geography is a consequence of marine action. The inland swamp is one which now is under the pluvial or riverine action or whose development is geographically riverine.

(2) Classification of swamps

25. The swamp is roughly classified into two types as defined above, and is also subclassified into five kinds as below.

Classification of swamps

a) Coastal swamps (influenced or developed by sea water)

i) Mangrove swamp (influenced by brackish water)

ii) Sand-dune swamp (influenced by brackish water or rainfall)

iii) Tide influenced swamp (influenced by river water and tidal backwater)

b) Inland swamps (influenced or developed by river)

iv) Water-logged swamp (influenced by river water or rainfall)

v) Seasonal swamp (influenced by river water or rainfall)

III-3 Swamp Development and Land Use

26. In Malaysia, the construction of irrigation facilities for paddy fields is under way for the promotion of double cropping. There are no large-scale public irrigation works for upland fields, with the exception of private facilities owned by some farmers in Cameron Highlands, etc. As regards the drainage, backwater gates and arterial drainage canals are being constructed in some areas, but farmland drainage by pumping, embankment for flood control, etc. are not yet constructed.

27. On the other hand, it is too much for the new settlers to the developed swamp area to expect a high productivity from the outset. All these conditions suggest that exorbitant investment in swamp development is not justifiable from the economic viewpoint and that the construction of facilities necessitating sophisticated maintenance and servicing is also not justifiable from the technical viewpoint.

28. In view of this, the master plan is formed on the presupposition that the irrigation facilities be limited to paddy fields alone and that large-scale embankment, coastal dyke, pumping station, etc. be omitted. For this reason, the swamps coming under one or other of the following are excluded from the master plan.

i) Swamps which are almost on a level with the river and are always endangered by flood.

ii) Swamps of a low level which are connected to a tidal river and influenced by brackish water.

iii) Swamps of a narrow strip and whose arability is low.

iv) Swamps of small area and located too remote from the existing communities to defy the formation of a community.

v) Swamps which have already been tilled or come under other projects in motion or in contemplation.

vi) Swamps of sand-dune where agriculture is not possible without irrigation.

III-4 Development of New Communities

29. The relationship between the farmhouse and farmland of a farming household exists in two types; one in which the farmhouse stands on the farmland, and therefore the farming households are sparsely located, and the other in which the farming households form a close community detached from their farmland. The former type will be convenient and efficient for the farmers to go to work and make rounds of their farmland and livestock. On the other hand, the latter is convenient for communication and cooperation between the farming households and for the use of public facilities such as school, public hall and market.

30. Now we will define the former as dispersed farmstead type or simply dispersed type and the latter as community type. Choice of either dispersed type or community type depends on the type of farming, traits of national character, etc. In this modern age, however, the community type is not only beneficial, but also prerequisite to the farmers for the following reasons.

i) School education has been popularized, and children will feel relief in going to and back from educational institutions such as kindergarten and elementary school.

ii) Each separate farming household can be on a small scale, and may not have agricultural machinery. For the purpose of improving the farming efficiency, cooperative use of agricultural machinery is almost imperative. The community type is convenient for the communication and rotation of machinery.

iii) The community type is convenient for the collection, storage and shipment of agricultural produce.

iv) The community type also works well in collective purchasing, storing and distributing fertilizer, chemicals and capital goods.

v) In modern society, there are many common elements the people must share with each other. Common

antenna radio and television systems, group physical examinations, joint promotion of cultural activities, and joint use of utilities are a few examples of them. All these warrant the community type.

31. In the villages where the dispersed type is traditional, joint use and operation or cooperative undertakings are too often shunned, hampering the formation of new communities. The swamp development under the master plan is the development of the jungles.

32. Thus, it is possible to carry out planned development of farmland and housing sites and to assign any type of community system for the settlers. In the new agricultural development programs in Malaysia, a community type called the new town is employed almost entirely. In this master plan, the community type will be employed and called the new town. The layout of the new town will be carried out according to the following requirements.

i) The minimum number of farming households in a new town will be 75. This is predicated upon the assumption that two thirds of the farming households will have at least one schoolchild, that a class of fifty pupils can be formed as a unit, and that large farm machinery can be used jointly.

ii) In the early stages of settlement, the farming will be carried out manually or by draft animals. Going to and back from farmland will be by bicycle or motorbike. Thus, the new town will be developed so that the farm lot farthest from the new town will be within 2.5 miles from the new town. In the near future, however, small trucks or trailer tractors will be used increasingly.

iii) The new town will be located near the existing or new arterial roads for convenience of traffic and of communication with the existing communities.

iv) For the construction of the new town, lowlands near river or prone to flooding or lands of bog soil or other poor soil will be avoided.

33. In the future, administrative measures should be provided so that the new town and existing communities will have the following relationships.

i) Few existing farming communities have public facilities. If there is an existing community near a new town to be constructed, the capacities of school, public hall and utilities such as water and electricity should be studied and set inclusively it.

ii) Administrative guidance should be provided so that the farmers' association, farming facilities, etc. will be open to the existing communities.

iii) Part of the developed swamp area should be available for those existing farmers whose farming operations are not enough because of undersized farmland.

III-5 Systems of Management, Promotion and Education

34. In the area developed according to the master plan, new facilities and way of management which are not found in the conventional farming in Trengganu will be introduced. The young silkworm rearing station and silk yarn mill for integrated sericulture, etc. will be typically new appurtenances. Joint use of agricultural machinery, cooperative collection and shipment of agricultural produce and other undertakings are a new way of management. For the purpose of getting all these off the ground, it is required to establish proper maintenance and management systems and the functions for education and training of the farmers.

(1) Maintenance and management of facilities

35. Principal facilities which necessitate maintenance and management are as listed below.

i) Irrigation and drainage facilities

Maintenance, inspection and servicing of irrigation pumps; weeding and clearance of sediment load from the irrigation channels and drainage canals.

ii) Roads

Repairs of roads.

iii) Production facilities

Young silkworm rearing facilities, agricultural machinery center, etc.

iv) New town

Maintenance, inspection and servicing of electric power supply facilities, water supply facilities, and public buildings, etc.

36. When the farmers' association and management systems are built up to turn out skilled farmers and technicians, such farmers and technicians should preferably carry out the activities as referred to above on a voluntary basis. It will take some time for the farmers to be able to perform such activities, and the KETENGAH, the principal of the development project, should undertake such activities for the time being.

(2) Education and training of farmers

37. When the development is completed according to the master plan, more than 10,000 homesteaded households, more than 1,000 operators and mill workers will be settled. Most of the settlers will be unskilled in the trades they are committed to, because those who wish to come to the area to be newly developed are mostly dirt poor farmers, laborers, and coastal fishermen who are below the poverty line.

38. It is desirable to settle persons, experienced and inexperienced, in proper proportions in each developed area. However experienced in farming the settlers may be, they, together with inexperienced settlers, should be thoroughly educated and trained before being settled because the project is designed for modern agriculture and also because new sectors such as sericulture are introduced. The settlers should be indoctrinated by experts of broad knowledge and experience and drilled at training facilities in the respective fields. These experts and facilities should preferably be under the control of KETENGAH.

39. The training center will offer two courses; one is an advanced course for fostering extension workers, who will receive lectures and training by experts of various fields, and the other is a farmer training course in which farmers will receive intensive training concerning respective sectors they are committed to.

40. The training services for farmers should be chiefly undertaken by the extension workers who have granduated form the advanced course.

IV. PRESENT STATE OF REGION

IV-1 Natural Conditions

1-1 Location, topography and vegetation

41. The State of Trengganu lies at about the center of the eastern part of Peninsular Malaysia, or more precisely within a tract of lat. 5°50'N to 3°50'N by long. 103°30'E to 102°25'E. Its eastern part forms an arched coastline jutting into the South China Sea, and the western part is mountains belonging to the East Coast Range.

42. Trengganu borders Kelantan on the north and Pahang on the south. The hilly area in the west is a range of mountains of 3,000 to 5,000 feet high, and the principal running direction of the mountains is NNW to SSE.

43. It forms first-rate tropical rain forests, and is headwaters of the rivers in Trengganu. Fig. IV-1 illustrates an outline of the topography of Peninsular Malaysia. The hill belt adjoining the mountains forms, together with such mountains, the eastern part of the Trengganu Highlands, which thrust their way nearly into the coast. The original form of the tropical rain forests is undergoing a serious change because of the active development of forest resources, oil palm plantations and rubber plantations in recent years.

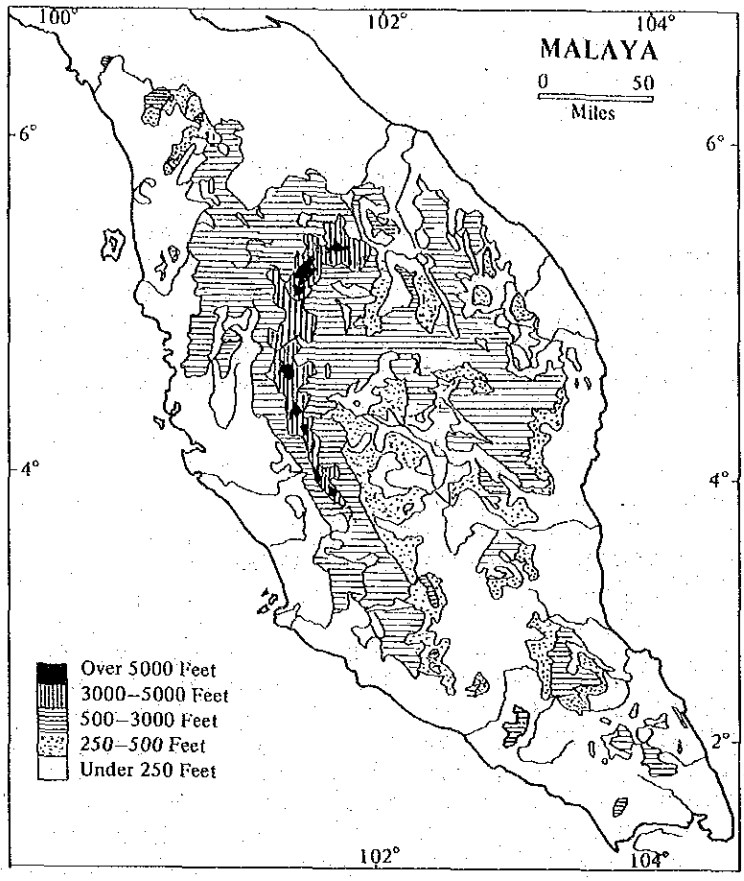


Fig. IV-1 Relief and Main Mountain Ranges

Source: Doi Jin-Bee; Land, People and Economy in Malay (1963)

44. There is a sand-dune belt of about 1-4 miles wide running parallel to the coastline between the Trengganu Highlands and the coastline. The sand-dunes are said to have been developed by repeated aggression and regression in the Pleistocene epoch. They are characterized by poor vegetation, depauperate bushes and groves (mainly Gelam). Because of poor water retentivity, the dunes often fail to sustain vegetation in the dry season. The downs near the sea have well-developed communities and are equipped with major roads.

45. The coastal plain is under-developed. Unlike the West Coast, the East Coast is directly exposed to the winds and waves of the open sea, and is prohibited from retaining riverine and marine deposits to form a plain. However, there are plains spottedly in the lower

reaches of the major rivers such as Trengganu, Dungun and Kemaman. Although they are small in area, they are important granaries. The swamps to which the master plan study is applied are formed, for the most part, in the lowlands extended dispersedly within the hill belt and the coastal zone including dune belt and coastal plains.

46. In the State of Trengganu, an area of 2,169,000 acres is occupied with forests accounting for 68% of the total area. An area of 1,313,000 acres is occupied by Primary Hill Forests of commercial values, accounting for 60.5% of the total forest area. Swamp forests occupy a total area of 138,000 acres or 6.4%. Forests in the state are classified under Tropical Rain Forests.

47. They range widely from Littoral forests on the East Coast to Hill Dipterocarp forests found in highland along the boundary lines with the States of Kelantan and Pahang. Mangrove swamp forests are not large in area and growing stock due to strong seasonal wind and sandy soils on the coast.

48. Another type of Littoral Forests, Beach Forests, stand on sandy soils and bleached sand. The majority of them are Heath Forests. Major species found are Aru (Casuarina spp.) and Kayu puteh (Melaleuca leucaclenclron) often growing in groups. Behind Littoral forests, swamp forests are found, which are classified into freshwater and peat swamp forests. In the latter, a number of species are found such as Kelat (Eurgenia spp.), Penarahan (All species of Sapotaceae), Geronggang (Craloxylon sp.), Nyatoh (Most species of Sapotaceae), Terentang (Camprosperma spp.), etc.

49. In further inland, both lowland and hill Dipterocarp Forests are found. They are dominated by Dipterocarps of fine quality such as Meranti group (Shorea spp.), Keruing (Dipterocarps spp.), Kapur (Dryobalanops spp.), Balau (Shorea spp.) , In addition, many other quality timber with high commercial value is found besides non-Dipterocarps such as Nyatoh, Jelutong (Dyera constulate), Kempas (Koompassia malaccensis), Mengkuland (Some Heritiera spp.) and Septir (Sindora spp.).

50. Utilization of timber is very limited at present due to geographical restrictions. But, it is not difficult to foresee that their utilization will be hastened before long by construction of access roads as development of lowland into farmland proceeds in accordance with the implementation of the Malaysia Plan. According to the FAO's survey in 1972, the manufacturing capacity of wood-based industry in 1970 is estimated to grow by 7.5 times during the period of the Fifth Malaysia Plan (1986-90).

1-2 Climate and hydrology

(1) Climate

51. Roughly speaking, Malaysia belongs to the tropical monsoon zone. The term, "tropical", refers to such an area than has an average temperature of 18°C or higher in the coldest month of the year. The monsoon is a season when a wind called the monsoon blows which brings about a rather wet period of the year. In the East Coast of Peninsular Malaysia where Trengganu lies, the monsoonal season usually continues from November to January and is characterized by rainfalls. Therefore, this season is also called the rainy season.

52. The rainy season does not always take a definite time of the year; it may happen in the September to October period or in the March to May period. The dry season, though so termed, has an average monthly rainfall of 150 to 200 mm, which changes from year to year, and cannot be said to be a dry season in the exact sense. The monthly average temperature is 26°C to 28°C with little change throughout the year, but the temperature in the rainy season is somewhat low.

(2) Hydrology

53. There are many rivers in the central and southern parts of Trengganu. They include Trengganu, Marang, Dungun, Paka, Kerteh, Kijal, Kemasik and Kemaman. They all are small in size so long as the catchment area is concerned. The flat terrains in the lower reaches of these rivers are often flooded in the rainy season. The runoff velocity of storm-water is slow, and the concentration is small.

54. Accordingly, high water level in the lower reaches rises gradually at the time of heavy rainfalls, and the flood-plain drains gradually after one to three days of submergence. Of the rivers cited above,

Trengganu, Marang, Dungun, Paka and Kemaman are equipped with gauging stations of the DID. The probability calculation of flood occurrence is possible using the data obtainable from the DID.

55. The rivers of which statistical data have been well kept are listed as below.

River	Station	Record period
Sg. Marang	Peng Setor Kanan	Oct. 1966 to Dec. 1978
Sg. Dungun	Kg. Keriyu	Sept. 1962 to Dec. 1978
Sg. Kijal	Jam Kijal	Sept. 1971 to Dec. 1977

56. At these stations, the daily water levels have been measured at 6:00 am and 6:00 pm. The high water level of the river for various probability years can be calculated from these data.

1-3 Geology and soils

57. Geology in West Malaysia was formed as a result of orogenic movement which progressed markedly in the Southeast Asia in the Palaeozoic and the Mesozoic eras as illustrated in Fig. IV-2.

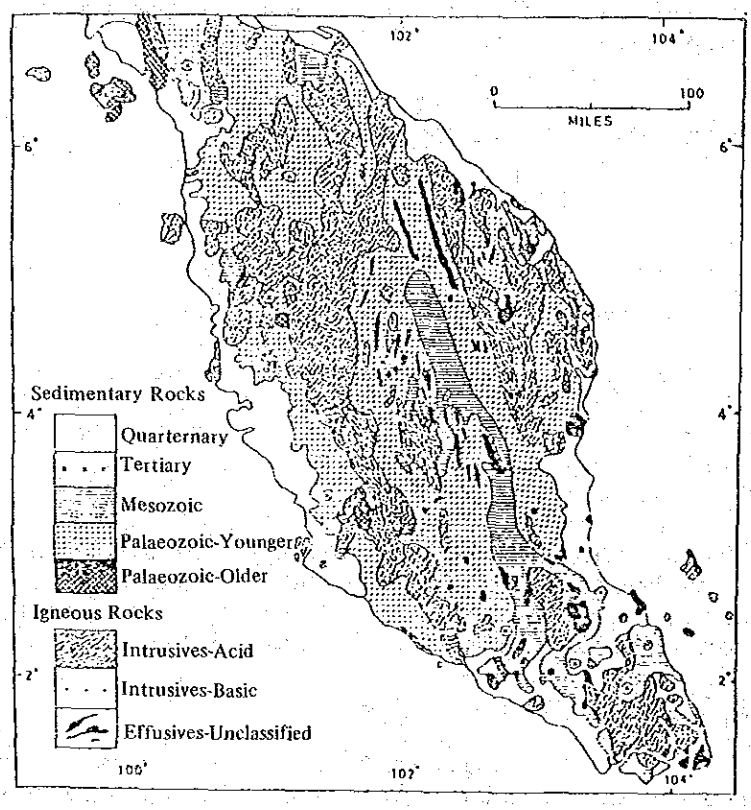


Fig. IV-2 Geology

58. Region under the master plan study belongs to the Eastern Malaya-Kalimate Orogenic Zone. The geosynclinal system in the region was developed in the Carboniferous period in the Upper Palaeozoic era, and the sedimentation was nearly completed in the Triassic period of the Mesozoic era.

59. The sediments in this period included sand, silt, clay, and quartzite pebbles. Later, sedimentary rocks such as sandstone, quartzite and shale were formed.

60. Then, upheaval followed, and magmatic emplacement of sedimentary rocks took place in the Jurassic period of the Mesozoic era, forming granitic hill belt and mountains.

61. The swamps are distributed in the lowlands of the hill belt and coastal zone developed by the orogenic movement explained above. Thus, the origin of the swamps may be traced back to the end of the

Mesozoic era to the beginning of the Tertiary period. But, the existing swamp ecosystem will be based on the Quarternary period. Judging from the parent rocks and parent materials, the soils of the region may be classified into the following three.

i) Acrisols, Nitosols and Gleysols made up of sedimentary rocks of the Palaeozoic era (mainly in the Carboniferous period) as parent rocks and their weathering products as parent materials.

ii) Acrisols, Nitosols and Regosols made up of intrusive igneous rocks (chiefly granite) as parent rocks and their weathering products as parent materials.

iii) Gleysols, Fluvisols and Histosols made up of the Quarternary period sediments (mainly riverine and marine deposits of the Holocene epock and peat) as parent materials.

62. Of these, Gleysols, Histosols and Regosols form the swamp soils.

IV-2 Socio-Economic Conditions

2-1 Population and labor force

63. The State of Trengganu is made of five districts with a center at Kuala Trengganu (population 65,000 as of 1977). According to the MTR of the TMP, it is estimated that the population of Trengganu will increase from 495,000 at the end of 1977 to about 540,000 in 1980. The population of the state, however, is only 4.8% of the Malaysian total. From the viewpoint of community, it is projected that in 1980 Malay will reach 506,518 (93.6%), Chinese 29,578 (5.5%), Indian 4,313 (0.8%) and others 841 (0.1%).

64. It is also projected that the population by age-group will be 87,711 (16.2%) of 0 to 4 years old, 139,784 (25.8%) of 5 to 14 years old, 113,382 (21.0%) of 15 to 24 year sold, 180,899 (33.4%) of 25 to 65 years old, 19,474 (3.6%) of 65 years old and above. Compared with that of the whole Peninsular Malaysia, Trengganu has a larger proportion of the youth. By sex, there is no significant difference in total. By community, however, the percentage of the male to female ratio is 49.6% to 50.4 in the case of Malay, while that of Chinese and Indian is 56.0 to 44.0 and 57.6 to 42.4, respectively. In the case of the minorities, the ratio is 41.0 to 59.0.

65. From the population forecast according to the 1970 Census, it is estimated that the employable population will be 145,614 males and 148,669 females or 294,283 in total. By community Malay will account for an overwhelming 92.2% or 271,365, Chinese for 6.7% or 19,757, and Indian and other minorities for respectively less than 1%.

66. The MTR of the TMP estimates that the ratio of the employable population to the total in 1980 will be 56.8% in whole Malaysia and 54.4% in Trengganu, a little short of the national average.

67. According to the MTR of the TMP, it is estimated that the ratio of the working population to the employable population in 1980 will be 64.4%. This value may not be applied directly to Trengganu where Malay shows an overwhelming majority, but if this value is applied, the working population in Trengganu happens to be 189,517 in 1980.

68. Every industrial sector shows a considerable employment growth on the national average from 1978 to 1980. In Trengganu, the employment growth is expected to be conspicuous in mining and quarrying, manufacturing, etc., and will be somewhat different from the national average. Because of in availability of required data, the growth by sector of employment in Trengganu is figured out by making use of the national average growth rates as follows:

Table IV-1 Employment Growth by Sector, Trengganu, 1978-80

Sector	Estimated Employment in 1978	Estimated Increasing Ratio of 1978 to 80 1/	Estimated Employment in 1980
Agriculture, forestry, livestock and fishing	79,529	2.6 (%)	81,597
Mining and quarrying	4,789	1.7	4,870
Manufacturing	5,572	6.4	5,928
Construction	3,947	15.5	4,559
Services	29,757	9.1	32,465
Total	123,594		129,420

1/: Calculated using figures on employment shown in Table 4-6 MALAYSIA: EMPLOYMENT GROWTH BY SECTOR, 1978-80, MID-TERM REVIEW OF THE THIRD MALAYSIA PLAN 1976-1980.

As mentioned previously, the working population in 1980 in Trengganu has been estimated to be 189,517. In Table IV-1, however, the employment is estimated at 129,420. The balance of approximately 50,000 are out of employment, that is, the unemployed.

69. As mentioned previously, the working population in 1980 in Trengganu has been estimated to be 189,517. In Table IV-1, however, the employment is estimated at 129,420. The balance of approximately 50,000 are out of employment, that is, the unemployed.

2-2 Administrative organization

70. According to the provisions stipulated in Articles 74 and 77 of the Constitution, the Federal Government is obliged to undertake activities concerning pest control, cooperatives, price control, technical researches and studies. On the other hand, the state government is required to deal with general matters concerning agriculture and forestry, privity of contract between landlord and tenant farmer, homesteading, soil conservation, rental control, etc. For matters concerning livestock industry, veterinary services, animal quarantine, irrigation and drainage, the Federal Government and the state governments are required to cooperate with each other.

71. Each state is presided over by a Sultan who corresponds to the King of the Federal Government. The state executive council consists of the state secretary, state financial officer and state treasury, under which the agricultural department, veterinary department, etc. exist. In principle, the Federal Government executes the power of appointing and dismissing the director of the agricultural department. An officer of the Federal Government is appointed director.

72. Administratively, the state is divided into several districts. In Trengganu, the administrative territory is divided into six districts, Besut, Kuala Trengganu, Ulu Trengganu, Marang, Dungun, and Kemaman. Each district is divided into several Mukim, which is further subdivided into several Kampongs. The chief of a district is the district officer, and the chief of a Mukim is a Penghulu. The chief of a Kampong is a Ketua Kampong. All these manage the affairs within respective administrative units and assist the Federal Government in executing its policies.

73. As regards the agricultural administration, the state government has several bureaus, such as Management, Extension, and Development. Of the various activities, crop production, plant protection, soil and analytical services and coconut rehabilitation and replanting are directly undertaken by the Federal Government.

74. As regards the agricultural administration, the state is divided into two to three regional administrative units. An agricultural officer is assigned to each regional administrative unit, and assistant agricultural officers are despatched to regional offices for various administrative services, including extension work.

2-3 Economy and finance

75. According to the MTR of the TMP, the GDP in Trengganu increased from M$357.8 million in 1975 to M$528.9 million in 1978, and the per capita income increased up about 50% from M$737.7 in 1975 to M$1,005.5 in 1978. Compared with Selangor, the largest and most advanced state of Malaysia, the per capita income of Trengganu is only 32%. Table IV-2 shows the GDP by sector of industry and per capita income in Trengganu in 1975 and 1978.

Table IV-2 Breakdown of GDP by Industry of Origin Trengganu State, 1975 and 1978

(M$ million in constant 1970 price)

	1975		1978	
	Amount	Percentage (%)	Amount	Percentage (%)
Agriculture, Forestry, Livestock and Fishing	171.2	47.8	223.0	42.2
Mining and Quarrying	6.3	1.8	57.5	10.9
Manufacturing	23.4	6.5	40.4	7.6
Construction	13.2	3.7	18.0	3.4
Services 1/	143.7	40.2	190.0	35.9
Gross Domestic Product(G.D.P.)	357.8	100	528.9	100
Population (000)	485		526	
Per Capita G.D.P.(M$)	737.7		1,005.5	
Ratio to Malaysian Average	0.52		0.60	

1/: Includes - (a) Utilities;
(b) Transport, storage and communications:
(c) Wholesale and retail trade:
(d) Banking and insurance:
(e) Public administration and defence:
(f) Ownership of dwellings and real estate:
(g) Other services:

76. As is clear from the above table, the economy of Trengganu in 1978 improved much compared with that in 1975. This is because the crops as represented by rubber plants and oil palms planted in the 1970s reached cashable maturity and because the oil production off the coast of Trengganu got off the ground.

77. According to the provisions of the Constitution, the economy of a state is financed with the revenue the state earns and also with the funds from the Federal Government. As with the Federal Government, the state government has been feeling inveterate balance-of-payments deficits on account of development spending. The deficits are covered by the Federal Government's subsidies, loans and others. It is estimated that the deficts will have amounted to M$620 million in 1978.

78. The Federal Government's subsidies to Trengganu were originally M$911 million according to the TMP, but were increased to 64%, to M$1,491 million. Increased were the economic sector by 84.0% to M$1,252,99 million, social sector by 17.3% to M$196.54 million, general administration sector by 3.8% to M$29.67 million and the security sector by 11.8% to M$11.66 million.

2-4 Public utilities

79. The works for electric and water supplies have been pushed forward steadily according to the TMP. At present, some thermal power plants have been serving major cities, including Kuala Trengganu, for 24 hrs., but in the rural areas, the power service is only for 12 hrs. On the completion of major power stations and transmission lines, some under construction and others in the stage of implementation design, the national grid system will cover a major part of Trengganu with an improved power supply. According to the data available at the time of the master plan study, Trengganu has major power stations, such as Kuala Trengganu, Kemaman and Dungun, and several minor community power stations. Their outputs are 14.76 MW, 2.8 MW, 2.8 MW and 0.64 MW, respectively.

80. A dam called Kenyir is under way in the upper reaches of the Trengganu river, and is scheduled to be completed in 1984 with an output of 400MW, the largest in Malaysia. The spendings for the Trengganu hydro-electric power projects for the 1976-80 were revised from the initial M$27.4 million to M$100.0 million according to the MTR of the TMP.

81. Kuala Trengganu and other major cities are equipped with water supply facilities to some extent. In the rural areas, utility water supplies are installed to a considerable, if not sufficient, degree. According to the MTR of the TMP, the budget for the 1976-80 community water supply projects was increased from initial M$12.3 million to M$16.5 million.

2-5 Communication and transportation

82. In Trengganu, the major roads, particularly the highway running north to south along the coast, have been well developed from of old. This coastal highway, which is called Route III, is a Federal East-West Highway, leading to Kuala Lumpur and Johor Bahru by way of Kota Bharu in the north and Kuantan in the south. Route III is classed among List IV; its maximum allowable load is 11.18 tons, the width is 22 feet, and the shoulders are 8 feet in the normal run and 4 feet in the hilly terrains. The daily average traffic volume is a little more than 10,000 vehicles in and around Kuala Trengganu and Dungun, though it varies largely depending on locations.

83. In the Trengganu Tengah Region, the KETENGAH has been promoting its road construction plan since 1974. KETENGAH's roads are planned to intermesh rubber plantations, oil palm plantations, other plantations and new towns built up by farmland development, and the roads running north to south in parallel with Route III serve as a bypass. The intra-state road network and road plans, particularly in the region, are spreading south of the Trengganu.

84. According to the MTR, it is estimated that the community roads planned in Trengganu for the 1976-80 period will have an aggregate length of 350.2 miles, and that the construction costs will amount to M$417.5 million. Of 350.2 miles, those concerning the existing projects are 124.0 miles, and those for new projects are 51.8 miles, the remaining 174.4 miles being road improvements.

85. In Kuala Trengganu, there is an airdrome for domestic flight services. In 1975, air passengers reached 10,500, and in 1978 they amounted to 14,400. The air cargo was 25 tons in 1975 and 57 tons in 1978. The airdrome is scheduled to be improved according to an airport reconstruction plan, and air traffic volume in terms of both passengers and cargo will shoot up largely in the future in pace with the economic growth of Trengganu.

86. The telephone network is far from enough, but in the medium and large cities, telephone services are available to the general public. There is a radio station in Kuala Trengganu. TV link stations are installed in Kuala Trengganu and a few other cities to cover a majority of households in the state.

2-6 Health and hygiene

87. According to the MTR of the TMP, the national total of doctors is 2,757 in 1975 and 3,058 in 1978. In Trengganu, the number of doctors is 51 (1.8% of the national total) in 1975 and 61 (2.0%) in 1978, respectively. In whole Malaysia, the population per doctor is 4,460 in 1975 and 4,347 in 1978. In Trengganu, the population per doctor is 9,509 (213.2% of whole Malaysia) in 1975 and 3,622 (198.3%) in 1978, respectively. These statistics are as shown in Table IV-3.

Table IV-3 Number of Doctors and Population per Doctor Trengganu State, 1975-78

	Trengganu (A)	Whole Malaysia (B)	A/B X 100 (%)
Number of doctors 1/			
1975	51	2,757	1.8
1978	61	3,058	2.0
Growth rate (1975-78) %	19.6	10.9	
Population per doctor			
1975	9,509	4,460	213.2
1978	8,622	4,347	198.3
Growth rate (1975-78) %	- 9.3	- 2.5	

1/: Include the private practioner.

88. In addition to the hospitals, the public health facilities include health centers, health sub-centers and maternity hospitals, the installation of which is an important project. In rural areas in Trengganu, the population per health center is 19,000 as against about 21,000 in whole Malaysia, and the population per clinic (including maternity home) is about 3,000 as against about 4,300 in whole Malaysia. Although Trengganu is well provided with welfare facilities so long as viewed from the national average, its welfare still is far from enough.

2-7 Land use

89. In 1966, the Ministry of Agricultural Cooperatioes conducted a survey on land use in Trengganu. As illustrated in the report, agriculture in Trengganu is developed chiefly in the coastal area and along the major rivers. There are two major rivers, Trengganu and Besut. Other rivers include Paka, Dungun and Kemaman. In the last ten years or so, agriculture seems to have been gradually developing in inland flat terrains and in small river basins, in addition to the areas referred to above.

90. The State of Trengganu has an area of 5,050 square miles, of which cultivated lands account for about 14% or 464,000 acres 1/. On the other hand, the forests are about 70% or 2,170,000 acres. According to the statistics by the Ministry of Agriculture, the cultivated area in Trengganu in 1973 was 336,600 acres. It is evident that the difference is derived from the large-scale agricultural development of rubber and oil palm plantations by KETENGAH, FELDA, etc.

91 According to the 1978 agricultural statistics reported by State Agricultural Department, Trengganu, the approximate planted area for major crops is 258,000 acres for rubber, 132,000 acres for oil palm, 90,000 acres for paddy, 30,000 acres for coconut, 12,000 acres for cashewnut, 8,000 acres for tobacco, and 3,000 acres for pineapple. Of these crops, paddy is planted mainly in the river basins nearby Kuala Besut, Kuala Trengganu and others.

92. Rubber and oil palm are grown chiefly in inland areas, particularly in Trengganu Tengah Region. Coconut fields are seen mostly in the coastal area. Tobacco is grown in Kuala Trengganu, Kuala Besut and their neighborhood. As discussed separately, the Trengganu Tengah Region for which the master plan study was made is producing various crops led by rubber and oil palm from estates and settlements.

1/Source: State Planning Unit, Trengganu, 1978

Table IV-4 Crop Acreges in Peninsular Malaysia, 1973, 1960 and 1965

(Unit: '000 acres)

State	Total Cultivated Area	(%)	Rubber	(%)	Coconut	(%)	Paddy	(%)	Oil Palm	(%)	Miscellaneous Crops	(%)
Johore	1,665.4	23	1,085.2	26	135.3	25	6.8	1	350.1	32	83.0	22
Kedah	790.0	11	425.8	10	29.0	5	296.8	32	10.8	1	27.6	7
Kelantan	486.1	7	208.9	5	43.7	8	179.5	19	12.9	1	41.1	10
Malacca	507.0	4	252.0	6	12.0	2	27.1	3	10.1		5.8	1
Negri Sembilan	677.9	10	576.1	14	7.2	1	23.3	2	62.9	6	8.4	2
Pahang	822.0	12	441.7	11	17.0	3	48.1	5	280.8	26	34.4	8
Penang and Province Wellesley	162.7	2	65.9	1	38.6	7	39.0	4	7.4	1	11.8	3
Perak	1,028.4	14	593.1	14	109.8	21	127.2	14	107.0	10	91.3	23
Perlis	106.8	1	14.2		3.3	1	65.9	7	-	-	23.4	6
Selangor	758.2	11	372.3	9	110.3	21	49.5	5	183.1	17	43.0	11
Trengganu	336.6	5	150.3	4	31.5	6	73.9	8	51.8	5	29.1	7
		100		100		100		100		100		100
Peninsular Malaysia	7,141.1		4,185.5		537.7		937.1		1,076.9		403.9	
1960	5,900		3,889		520		929		110		452	
1965	6,504		4,328		527		950		240		479	

IV-3 Production Activities

3-1 General

93. Shifting agriculture is observed not only in Southeast Asia, but widely in the tropical and subtropical zones. In some part of Trenggaun, this primitive way of agriculture is still performed to produce upland paddy, banana, sweet ptato, millet, pumpkin, etc. When the field loses its fertility, farmers migrate to other places to newly cultivate. The wasted fields farmers quitted then turned into secondary forests called Belukar, which are low in productivity.

94. Apart from shifting agriculture, the ordinary agriculture in Malaysia is generally operated on a small scale; about 90% of farming households own 4 acres or less on the average. Of said 90%, about 70% have 2 acres or less on the average. Paddy leads the list of crops grown, followed by vegetables, soybean, groundnut, banana, potato, mango, papaya, coconut, etc.

95. The once autarkic Malay agriculture has been involved into the vortex of its hug monetary economy, and traditional paddy farming operated in a small way is feeling hardships in adapting to the new economic waves. Expansion of farmland is difficult because of various restrictions such as land system, and farmers do not get around to pushing forward irrigation and drainage works on a large scale. The agricultural production is sure to rise when the farmers can irrigate their fields and obtain fertilizer with ease.

96. As seen in the agricultural statistics on Trengganu, the current unit yield of paddy is a scanty 0.74 ton per acre in the rainy season and about 1.00 ton in the dry season. As regards the paddy fields, consolidation of farms is in progress. Nevertheless, small farmers are still dominant because the share-tenant system is firmly established. However, the Malay Reservation Act was enacted to reserve land, particularly farmland suitable for paddy farming, for the benefit of the Malayas, and the farmers' position has been much improved as tragic cases of poor farmers on a debt treadmill, always borrowing from one person to repay another, have decreased.

97. Vegetables have come to be grown more and more in Trengganu in recent years. According to the Agricultural Yearbook of the state, the acreage for the vegetables reached as large as 10,000 acres in

1978. The principal crops were cabbage, spinach, lettuce, potato, sweet potato, carrot, harricot and radish, etc. Originally, the vegetables were grown by the Malaysians of Chinese origin. In Trengganu, there are modern truck farms operated by Malaysians of Chinese origin.

98. In Trengganu, cattle and water buffaloes have traditionally been kept for tilling and other agricultural operations. In recent years, the number of cattle has been on the increase with increase in the demand for beef. On the other hand, advance of agricultural mechanization has cast a blight over water buffaloes which are in eclipse. The Malaysians including indigenous Malays do not eat beef so much, and there is not much hope in spite of government campaign that the cattle will increase sharply. The Malays do not eat pork just as the Malaysians of Indian Origin do not eat beef for religious reasons. The Malaysians of Chinese origin eat both, but their population in Trengganu is not so large. In Trengganu, therefore, the number of hogs kept is very small. Goat's meat and mutton are accepted by all races in defect of religious restrictions, and a considerably large number of goats and sheep are kept loose.

99. Like agriculture, fishing is operated in the traditional way. It is said that fishing has been operated on a rather extensive way in Trengganu since the mid-nineteenth century. Even at present, however, the majority of the fishing households operate coastal fishing using small boats and relying on the labor of family members. It is reported that what the Malay fishermen can catch a year is about 2 tons per head. For the smooth promotion of fishing, the Federal Government has introduced a subsidy system.

100. At present, Malaysia is the largest palm oil exporting country in the world. Coconut palms are grown along the coast. The productivity of coconut palms in the plantations is extremely high. Other plantation crops include cacao, coffee, pepper and pineapple, and their productivity has been improving in recent years.

101. In Trengganu, forestry is the largest industry but agriculture. Not only in Trengganu, but in other states in Malaysia, the typical forests are tropical rain forests endemic to equatorial zone. Camphor tree, lauan, and other Dipterocarpaceous trees are growing.

102. In Malaysia, the manufacturing industry, particularly in processing sector using agricultural, forestry and livestock products as feedstocks, is in the cradle. As regards rubber and palm oil, the processing business seems to have been put on the right track in keeping with the progress of large-scale farming.

103. So far as sericulture is concerned, Malaysia is underdeveloped. In Trengganu, there is a small sericultural center at Ajil, and mulberry is cultivated by farmers around it. Geographically, Malaysia is for promoting fisheries through buildup of fishing fleet, fishing gear and construction of fishing ports. In the monsoon season, high waves endanger the fishing operations, and the fisheries promotion is tardy in progress with a few exceptions. The greater part of catches is sold in the form of dried fish for want of storage facilities.

104. When we speak of agriculture in Malaysia, we cannot pass over plantations. The plantations have grown independent of the traditional agriculture explained in the foregoing, cultivating highlands and terraces which are not suitable for paddy farming. Rubber has been a major crop of storage facilities.

105. The rubber growing is carried out in two ways; one in which rubber planations. The plantations have called estates, and the other in which small farmers are operated chiefly by Malays. Most of estates are managed by modern farming, while small farmers make a poor showing because little capital prohibits the introduction of modern techniques. Rubber takes the foremost place among plantation crops, followed by oil palm which has been growing at a rapid pace in recent years. They are thought to be suitable for sericulture, and sericulture may grow into a major industry depending on the approaches to be taken in the future.

3-2 Paddy and upland crop farming

(1) Major crops and existing cropping pattern

106. Major crops and existing cropping pattern: In Trengganu, the plant which is grown in the most extensive way in terms of acreage is rubber, and oil palm and paddy come next. Others, such as coconut palm, cashewnut, and tobacco, occupy not so large an acreage. The planted areas of major crops are as shown in Table IV-5.

Table IV-5 Crop Acreage, Trengganu, 1978

Crop	Acreage	Crop	Acreage
	(acre)		(acre)
Rubber	258,130	Tobacco	7,630
Oil palm	132,259	Pineapple	2,867
Paddy	90,536	Cacao	2,691
Coconut	29,362	Coffee	495
Cashewnut	12,472	Sugarcane	349

107. The acreage by tenancy of rubber and oil palm is as shown in Table IV-6. In the estates and state-promoted plantations, acreage for oil palm is larger than for rubber. On the other hand, in small holders the acreage for rubber is narrow compared with that for oil palm.

Table IV-6 Acreage of Rubber and Oil Palm by Tenancy, Trengganu, 1978

	Rubber	Oil Palm
	(acre)	(acre)
Estate	33,081	40,248
Small holder	174,194	700
Other 1/	50,856	91,310
Total	258,131	132,258

1/: Means state-promoted plantations and others

108. Some small-scale paddy farmers work for nearby rubber farms in the morning and tend their own paddy fields in the afternoon, balancing their labor force rationally. As regards paddy farming, double cropping has been on the rise because of irrigation and drainage works promoted in the northern part of the state since 1973. The penetration of double cropping scheme, however, remains a little more than 10%. Along the West Coast, the double cropping is observed by more than half the paddy farmers.

109. The double cropping is rarely seen in the swamp area south of the Trengganu river. In the paddy fields on which paddy is grown once a year, tobacco, sorghum, etc. are raised as cover crops. In the dry fields, soybean, sorghum, cashewnut, pineapple, cacao, rambutan, durian and other tree plants are planted.

110. Of these, vegetables are intensively grown in the well-accessible sandy areas irrigated with well water or brook water. Red pepper is one of the most extensively cultivated spices. Others which are grown on a small scale include clove, nutmeg and pepper. In some areas, mulberry trees are grown for the purpose of sericulture.

(2) Damage of crops

111. As regards pest control, the agro-chemicals have been utilized widely, particularly for the protection in vegetable farms. The chemicals have made it possible to grow cabbages and other vegetables which in the past were hard to grow because of pest. There are many kinds of applicators used. The most widely employed applicators are knapsack sprayers.

112. The paddy suffers from various types of pest and insect damaged by Leptocoria acuta THUNPERG (PIANGGANG), Chilopoly chrysa MEYA (ULAT BATANG), Virus (Penyakit merah), Piricularia oryzae (Padi blast), and birds in 1978 were 10,415 acres (about 13% of total planted area) in the rainy season and 3,231 acres (25%) in the dry season. Weather does as much harm as it is useful. In 1978, there was no damage from flood. In 1977, 626 acres were damaged from floods. In the 1977-78 period, drought withered away 427 acres in the rainy season (0.6%) and 22 acres in the dry season (0.2%).

(3) Output of agricultural products

113. Table IV-7 shows the acreage, yield and total output of rubber, palm oil, coconut and paddy in 1974, 1977, and 1978. The acreage for rubber and oil palm has been growing since 1974 while that for coconut has been on the decline. As regards the acreage for paddy, it has been moving sideways for both rainy reason and dry season though it has shown changes year by year. The total output has been different from year to year. As the irrigation and drainage works for paddy fields are in progress, the production will gradually increase with increase in the acreage in the dry season.

Table IV-7 Acreage, Unit Yield and Production, Trengganu, 1974, 1977 and 1978

Kind of Crops	Acreage			Unit Yield			Production		
	1974 (acre)	1977 (acre)	1978 (acre)	1974 (ton/acre)	1977 (ton/acre)	1978 (ton/acre)	1974 (ton)	1977 (ton)	1978 (ton)
Rubber	150,300	232,039	258,130	0.35	0.57	*3/	1,461	3,083	*
Oil Palm	73,828	113,652	132,275	0.68	0.67	*	927	*	*
Coconut	31,667	29,461	29,362	*	*	*	*	*	*
Wet season paddy1/	71,200	65,564	71,130	0.50	0.65	0.74	34,390	25,895	54,888
Dry field paddy	3,690	15,071	6,269	0.29	0.47	0.53	1,070	6,036	3,731
Hill paddy	*	*	3,752	*	*	0.43	*	*	1,792
Dry season paddy2/	12,110	9,675	13,208	0.56	0.96	1.00	6,690	9,990	11,871

1/: Main season paddy

2/: Off-season paddy

3/: Not available

(Source: Annual Report, Tabatnn Pertanian Negi Trengganu, 1977-78)

(4) Present state of farm mechanization

114. The Federal Government and the State Government granted subsides for agricultural machinery, and now there are 245 4-wheeled tractors, 183 2-wheeled tractors, 81 pumps, etc. in service for agricultural purposes. They are mostly applied to vegetables and other cash crops. The tilling and leveling of paddy fields is carried out by water buffaloes or by hand. Water buffaloes work at the ratio of 0.25 to 0.5 acre/day, while a hand tractor shows a high efficiency of 4 to 5 acres/day.

115. The riding tractor is more efficient with a tilling capacity of 8 acres per day. Promotion of double annual cropping will be difficult unless farming is mechanized, because the sequence break between the previous harvesting and the following transplanting is short.

3-3 Livestock rearing

(1) Livestock

Cattle

116. The State of Trengganu ranks third in the number of heads after Kelantan and Kedah. 47,500 (as of 1974) heads of cattle in the State accounts for approximately 13% of the total number of heads in Peninsular Malaysia. On the assumption of an annual growth rate of 8%, the total number of heads in 1977, which was approximately 60,000 is estimated to have grown to 70,000 as of 1979. 99% of them are kedah-Kelantan (K.K.) and its crossbred.

117. The number of dairy cattle is negligible (0.1%) and almost all of the cattle in the State are beef cattle. Change in the number of heads slaughtered in the past few years is insignificant, probably indicating that demand and supply within the State is in balance. Thus, the State has entered a new era and supply of beef cattle to consuming areas in the country should be considered.

Water buffaloes

118. In spite of the fact that the role of water buffaloes as a draft animal has diminished in recent years, their number has increased at their meat is still strong on the market. According to the State Veterinary Department, it is estimated that about 30,000 heads of water buffaloes are in the State as of 1979.

Beef production

119. It seems that beef and water buffalo meat are not clearly distinguished in the market. A head of beef cattle is sold by farmers for M$450 - 650 (adult weighing 200 - 300kg) and water buffalo for M$700 - 1,000 (adult weighing 320 - 460kg). In the market, beef is sold at M$6.00 per kg. Due to inadequate rearing conditions, domestic beef is lower in grade than imported one. A modern slaughterhouse and market to be established in Trengganu in the near future will improve slaughtering and post-processing methods. Improved methods, together with the improvement of breeding and rearing methods will result in a higher price in the market.

Goat and Sheep

120. The total number of goat and sheep is estimated appriximately at 20,000, which are reared mostly for consumtion by their owners. They are sold at M$80 - 120 per head.

Poultry

121. Although the total number is not clear, it is estimated extremely large since every farming household rears chickens in their yard. At present, Peninsular Malaysia imports a large quantity of feed (annual quantity of 700,000 tons). But it is not realistic to expect a large-scale rearing in the State, which is distant from consuming areas.

Swine

122. According to statistics, the number of swine reared in 1977 is 1,746 while the number slaughtered is 6,860, indicating that a large number was brought into the State. Due to not only religious reasons but also feed conditions, as in the case of poultry, a large-scale operation will not be realistic.

(2) Current rearing conditions

Feed

123. At present, cattle, water buffaloes, goat and sheep are reared almost entirely on grass. Since processing of farm and marine products is not so advanced the utilization of their by-product is not practiced.

Rearing

124. Except for limited areas reserved for pasture mentioned later, livestock is normally reared on grass in fallow paddy (single cropping) and vacant land, and along roads. Almost no cut grass is fed at present. Livestock especially cattle, is simply owned as livestock literally except for a limited use for farming. Thus, farmers do not have a strong sense of business. The number of heads reared is one to two or three at most. Thus, it will be difficult for extension service to penetrate.

(3) Improvement of livestock

125. Five artificial insemination centers in Kuala Trenqqanu, Marang, Ulu Trengganu, Kg. Raja, and Kg. Buloh, distribute semen and provide service in order to improve cattle. However, no specific improvement policies have been established and it still is in the testing stage. At present, frozen semen is imported from Australia, and semen and service are provided to farmers without charge.

126. The current dominant species, Kedah-Kelantan (K.K.) is physically small due to climatic and rearing conditions. The species is characterized by low reproductive ability, late maturing, and low production of meat and milk. Therefore, improvement is required in these areas. It is noted, however, the species is best suited for climatic and rearing conditions in the State and aggressive improvement measures should be developed and implemented.

(4) Improvement of grassland

127. Approximately, 10,000 acres of land is registered as the reserved area for pasture. About 1,200 acres are either already developed or under development. In general, reserved areas are dispersed and one area is small ranging from 80 to 300 acres. Their development is costly and technically difficult since some of them are located along rivers without access.

128. But their development will bring about a number of advantages to farmers. Napier grass is good for cutting while others such as Guinea, Signal, Para and stylo are suitable for grazing on pasture. At present, seeds are sown with the exception of Napier grass.

3-4 Freshwater pisciculture

(1) General

129. In Trengganu, the freshwater pisciculture has been growing steadily. In 1977, the newly constructed ponds amounted to 24 or 13.15 acres, sending up the total number to 172 or 69.24 acres as of the end of 1977. Trengganu, however, is the smallest in the number and area of ponds among the East Coast states, and stands no comparison with the West Coast states where freshwater pisciculture is traditionally flourishing. The number and acreage of ponds in Trengganu are about 50% and 67%, respectively, of those in Kelantan which is the last but one. For Trengganu, freshwater pisciculture is an industry of great promise.

(2) Present state

130. The fact that statistical data on freshwater pisciculture lack confidence compared with those of marine fisheries is a problem common to both advanced and developing countries. Malaysia is no exception. According to the statistics, an estimated output from freshwater pisciculture in Peninsular Malaysia in 1977 was 8,890 tons, up 5.2% from the previous year.

131. The total area of fishponds in Peninsular Malaysia is 11,854 acres, and the average production per acre is 750 kg/year. Since the value for the total output was M$14,401,267, the average return per kg of product was M$1.6 and the output per acre was M$1,200. These average values are considerably high. If these values are applied to the freshwater pisciculture in Trengganu, the production in 1977 can be estimated to have been 52 tons or M$83,200.

132. The State Fisheries Department of Trengganu has stepping up efforts to expand freshwater pisciculture, and in 1978 a considerably large number of new fishponds were installed under the subsidy of the state government. Fishponds within the FELDA's rubber plantations in Berala about 20 miles north of Kuala Trengganu are a case in point.

133. In the plantations there are hollow spots not suitable for rubber growing. Thirty-two fishponds of about 0.25 acre each were constructed there and owned and operated by settlers. The State Fisheries Department distributes fry, lime and fertilizer to the settlers. The settlers operate these ponds as a side job under the guidance of the officials of the State Fisheries Department.

134. Lampan Jawa, Chinese carps (Ctenopharyngodon idellus, Hypophthalmichthys moritrix, Aristichthys nobilis), and common carp are reared mixed. About 500 fry are released in a pond, and in 6 to 8 months, the pond yields 500 to 600 lbs of fish on the average. The total production is low for the time being, and the fish is sold at a doller per pound to the settlers.

135. As is clear from this example, it is evident that freshwater pisciculture is payable even in inconvenient locations apart from consuming areas so far as proper financial and technical aids by the government are combined with the pond owners. When the hatchery planned at Kenyir Dam under construction in the upper reach of Trengganu river comes to a reality, various species of fry will be available for the increase of productivity.

136. In 1977, Trengganu produced 77,800 tons of marine fish, the largest in the four states along the East Coast, and the third to Perak and Selangor in whole Peninsular Malaysia. The per capita fish production in Trengganu is 157 kg, or 3.5 times as much as 41 kg on the average of whole Peninsular Malaysia excluding Trengganu.

137. This great quantity is too much for the people in Trengganu, and more than half the catches seem to be shipped outside of the state. It is also characteristic of fisheries in Trengganu that various fish are caught uniformly. The ratio of the top-ranking three species to the total of catches is 67% in Perak, 70.8% in Selangor and as small as 34% in Trengganu.

138. The catches show a seasonal change mainly due to a north-east monsoon which roughens the sea. In 1977, the catches in November, December and January when a monsoon blew fell 53% of the catches in the February to April period, 75.2% compared with the May to July period and 90% of the catches in the August to October period.

139. Freshwater pisciculture is advantageous over the existing method in that it permits planned production, marketing of optimum sizes and sale of live fish are possible. In the predative fishing in which one seraches far and wide for fish, his problem is how to sell his catches. In the pisciculture, how to raise salable fish is the matter. It is important to select marketable species there. Other important factors include a high availability of fry and ease of outure.

140. The fish is a poikilothermal animal, and is said to require little energy for maintaining body temperature or for motion. The fish has an ability to assimilate feed of a high protein component. The live weight gain per unit of protein taken in is better than that of cattle, swine and sheep. It is also reported that the live weight gain of fish is equal to or higher than that of poultry.

141. The fish meal, the main ingredient of assorted feed for fish, has been soaring in price all over the world, and the cost of freshwater pisciculture will be inevitably affected by it. It will become necessary to study on a long-term basis the production of natural feed by making use of kitchen waste, humous soil, etc. without costly fish meal, as a culture ground for the purpose of securing feed supply.

3-5 Sericulture

(1) General

142. In Malaysia, sericulture has just begun. The one and only sericultural station with facilities in Malaysia is an experimental station in Trengganu which has been experimentally operated by the State Agricultural Department since 1972 to culture mulberry and silkworm.

143. In Malaysia, the climate is stable throughout the year, and it will be possible to realize six to eight turnovers a year. When the sericultural techniques are established to meet the conditions peculiar to Malaysia, and if the sericultural industry is promoted to answer for the domestic demand, the sericulture will make much for the stabilized economy of agriculture.

(2) Varieties of mulberry

144. In the State Agricultural Department's Experimental Station at Ajil, Trengganu, the following four varieties of mulberries are grown.

M. alba Local-multilobed
M. alba Thai-single-lobed I
M. alba Thai-single-lobed II
M. alba Thai-multilobed Mii

(3) Varieties of silkworm

145. It is reported that the following seven types derived from three stocks, Chinese white x Thai yellow hybrid, Japanese Hozan x Ginku hybrid, and Italian hybrid are reared at Ajil.

Chinese white x Thai yellow (CwTyA),
Chinese white,
Thai yellow,
HG (Jap) (A) = Japanese x Chinese white,
HGTA = Japanese x Thai yellow,
ICA = Italian x Chinese white,
ITA = Italian x Thai yellow.

(4) Target of technical development

146. What the Malaysian Government has set out as operational targets is roughly as follows:

a. Production of 20 to 25 tons of mulberry leaves from a farm of 2.5 acres

b. 400 to 500 mulberry leaves for the rearing of silkworm hatched from a case of 20,000 eggs.

c. Feeding silkworm of one molt-old with 1.5 kg/day, silkworm of two-molt old with 4.0 kg/day and silkworm of three-molt old with 14 kg/day, every hatch of a case.

(5) Sericultural farmer

147. At present, sericultural farmers exist only in Trengganu. Seventy-nine sericultural farming households operate 73 acres of mulberry farms. All the cocoons produced are delivered to the Ajil Experimental Station of the State Agricultural Department at a price of M$9/kg.