ECOLOGICAL CHANGES AND HEALTH IN THE MUDA IRRIGATION SCHEME

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INTRODUCTION

ECOLOGICAL changes are continuously being effected in many parts of Malaysia. Perhaps one of the most significant is in the rice bowl of Malaysia, the Muda Irrigation Scheme, in Perlis-Kedah. This is one of Malaysia's largest agricultural development project and has been designed to enable double-cropping of more than one quarter of a million acres of padi land. Currently the Muda area produces about 45% of total padi production in Peninsular Malaysia.

The project area has had a long tradition of single crop padi cultivation which formed the main source of income and economic activity of more than 50,000 paid farming families. Indirectly the Muda Irrigation Scheme has provided income and employment opportunities for many thousands of others in the form of input supply industries, rural shop-keeping, rice-milling, and the maintenance of mechanical farm equipment. Currently the Muda area has a population of about 550,000.

More than $250 million has been spent on the engineering works alone. In addition, government investments in the form of agricultural research, extension, development of producers' organizations, marketing and artificial padi drying, amount to many millions of dollars more.

ENGINEERING ASPECTS

In order to supply irrigation water for double cropping, the Muda Irrigation Scheme called for the construction of 2 dams with a total surface area of 35 square miles, 61 miles of main canals, 564 miles of branch canals, 560 miles of drainage canals, a coastal bund 68 miles long, a tidal barrage across the Kedah River and 480 miles of farm roads.

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AGRICULTURAL ASPECTS

The principal crop grown is padi which accounts for almost 80% of land use. To be successful, double cropping requires the use of high yielding short term padi varieties, fertilizers, pesticides, the liming of acidic soils, a high degree of mechanization of farming operations and a strict adherence to a planting schedule. Double cropping was begun in 1970 and by 1973, 75% of the farms were being planted with high yielding varieties of padi, 97% of the farms applied fertilizers, 48% used pesticides and 85% had mechanised ploughing (Treasury Malaysia, 1975). However, these ecological changes naturally produced several major problems directly and indirectly related to health.

ECOLOGICAL CHANGES AND HEALTH

Padi cultivation in relation to pollution, fish, rats and the buffalo

The use of high yielding short term padi varieties makes a great deal of sense. Not only does it enable two crops to be planted but also ensures that each crop has a higher yield. During the single cropping period the average yields per acre were about 520 gantangs. In 1974 the yields had risen to about 630 gantangs per crop — an annual yield of about 1260 gantangs compared with 520 gantangs per year (Treasury Malaysia, 1975). The net incomes have increased. For example, in non-acidic soils income has more than doubled from $145 per acre during the earlier single cropping period to $312 during 1972-73 (Treasury Malaysia, 1975).

However, high yielding varieties are highly sensitive to cultivation practices, and fertilizers, pesticides and the liming of acidic soils must be carried out. This of course increases the overhead costs particularly since fertilizers are derived largely from petro-chemical products. For example the cost of fertilizers increased by 400% during the 2-year period 1972-1974, with inflation

rising by 45% during the 5-year period 1970-1975. To add to the problem the practice of modern agricultural methods and double cropping, with its consequent ecological changes, has resulted in several problems that have a direct bearing to the health and well-being of the people.

Due to the use of fertilizers and pesticides, a 90% reduction in the number of fishes breeding in padi fields has been reported, with the consequence that an important source of animal protein has been lost.

The number of rats have also increased. Where previously the fields were allowed to lie fallow for several months, agricultural activity is now an around-the-year feature and this seems to have removed one natural method of keeping the rat population down, with the consequence that much grain is destroyed and the danger from rat-borne diseases has increased.

Where previously the buffalo was able to graze on the fallow land, the use of agricultural lands all the year round, has severely reduced the amount of land available for grazing. Consequently, the farmer has had to replace the buffalo with the mechanical plough. Of course this process of mechanization has many advantages such as speed and thus the ability to adhere to the strict schedule of planting mentioned earlier. Thus by 1973, 85% of farms had changed to mechanized ploughing. However, unlike the buffalo, a mechanical plough must be maintained, it uses expensive gasoline, deteriorates and may break down, and most importantly it is unable to reproduce and beget baby ploughs. Further, buffalo dung is a natural fertilizer but the grease, smoke and oil of the mechanical plough are pollutants. Finally, the buffalo is an important source of protein and is an important cultural element in the festivals related to the cycle of life (birth, marriage, illness and death) and to the cycle of planting and the year (the harvest festival and the Muslim festivals). Presently, with the virtual disappearance of the buffalo numerous cultural and social events are being undermined.

The planting schedule in relation to labour supplies and the rains

Another set of ecological problems are related to the planting schedule. As mentioned earlier, double cropping demands that farmers adhere strictly to a planting schedule. However, such a simple system has several important repercussions.

Strict adherence to a planting schedule means that there will be a shortage of labour. Where previously, mutual cooperation by *gotong royong* over several weeks provided sufficient manpower for the cultivation of rice, the reduction of time available, particularly in relation to transplanting, has meant that there is now a shortage of labour, with the need to import labour from outside the Muda area and a consequent increase in the cost of production.

Further, the off season crop is usually harvested during the rainy season and artificial drying has had to be used. This has not only increased the cost of production but there is the added problem that the padi may be lightly contaminated with mud with the consequence that its selling price is reduced.

Roads and motor vehicular accidents

The addition of almost 500 miles of farm roads combined ith mechanization and the use of motorised transportation has shifted deaths due to motor vehicular accidents, among those below the age of 20 years, from 6th position in 1970 to become the 2nd leading cause of deaths in 1975 (Singh, 1978). On the other hand, probably due to raised income levels, better communications as well as a general rise in the standard of living, acute gastroenteritis as a leading cause of death in those below the age of 20 years has dropped from 4th position in 1970 to 7th position in 1975, while bronchopneumonia has dropped from 2nd position in 1970 to 4th position in 1975 (Table I).

Irrigation canals, drownings, enteric fever and filariasis

As noted earlier the Muda Irrigation Scheme has added to the rice bowl 61 miles of main canals, 564 miles of branch canals and 560 miles of drains. A total of almost 1200 miles of canals and drains.

Consequently, deaths from drowning among youths below the age of 20 years has consistently remained as the second or third leading cause of death during the period 1970-1976 (Table I).

Table I
The ten leading medically certified causes of death in the age group 0-19 years, 1970 — 1976, the Muda area.

Order	1970	1972	1974	1976
1	Prematurity	Prematurity	Prematurity	Prematurity
2	Bronchopneumonia	Drowning	M.V. Accidents	M.V. Accidents
3	Drowning	Bronchopneumonia	Drowning	Drowning
4	Acute Gastroenteritis	M.V. Accidents	Bronchopneumonia	Bronchopneumonia
5	Tetanus	Acute Gastroenteritis	Acute Gastroenteritis	Congenital Anamolies
6	M.V. Accidents	Meningitis	Meningitis	Meningitis
7	Anaemia & Malnutrition	Tetanus	P.U.O.	Acute Gastroenteritis
8	Congenital Anamolies	Congenital Anamolies	Congenital Anamolies	Tetanus
9	Meningitis	P.U.O.	Tetanus	P.U.O.
10	P.U.O.	Anaemia & Malnutrition	Anaemia & Malnutrition	—

Source: Singh, A. (1978) Lapuran Kesihatan Kawasan MADA, 1970-1975.

One of the most dramatic problems has been a sharp increase in the number of enteric fever cases notified in the Muda area. Enteric fever notifications in Peninsular Malaysia as a whole has remained at a steady 12 cases per 100,000 population since 1957. In the Muda area it rose sharply in 1970 and seems to be associated with the amount of rice produced (Fig. 1).

Further, there is a suggestion that filariasis may be an increasing problem in the Muda area but this has yet to be confirmed.

General mortality rates

Have death rates decreased substantially in the Muda area? The answer is yes, they have (Singh, 1978). The infant mortality rate, which was higher

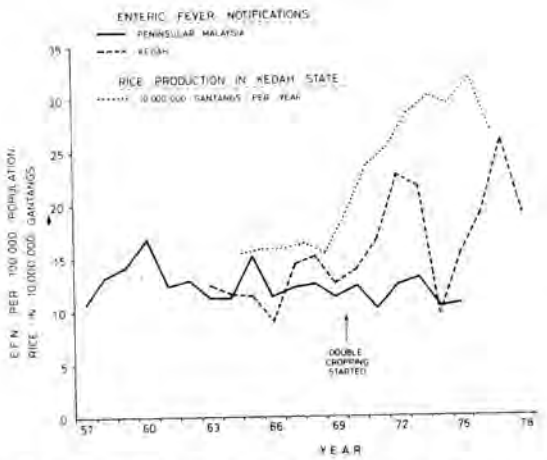

Fig. 1. Number of enteric fever notifications in Peninsular Malaysia and Kedah, and the amount of rice produced in Kedah.

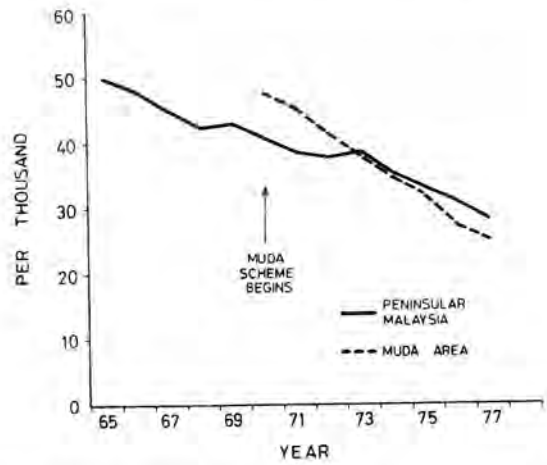

Fig. 2. Infant mortality rate in Peninsular Malaysia and the Muda Irrigation area.

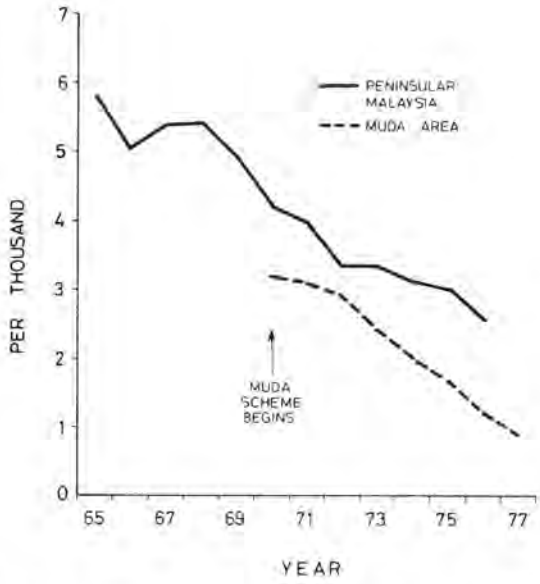

Fig. 3. Toddler mortality rate in Peninsular Malaysia and the Muda Irrigation area.

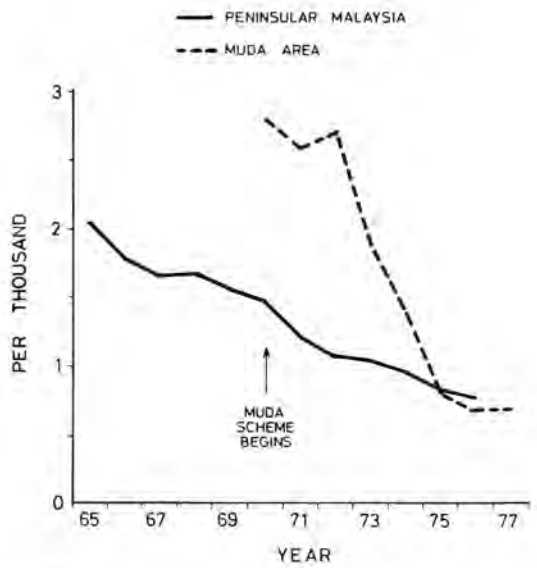

Fig. 4. Maternal mortality rate in Peninsular Malaysia and the Muda Irrigation area.

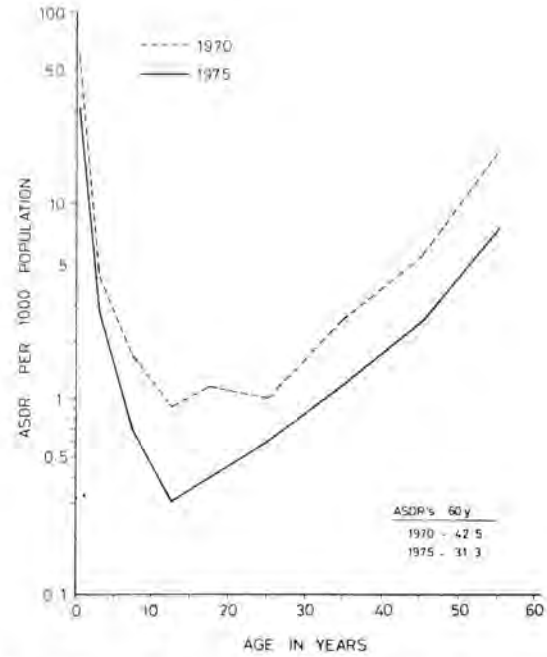

Fig. 5. Age-specific death rates in the Muda Irrigation area in 1970 and 1975.

than the national figure decreased to become lower than the national figure (Fig. 2). The toddler mortality rate decreased to half that of the national figure (Fig. 3). Maternal mortality took a sharp dive to the level of the national figure (Fig. 4). Age specific death rates for 1975 were lower, for all ages, than in 1970 (Fig. 5).

However, these decreases cannot be solely attributed to economic and other benefits brought about by irrigation and double cropping. Thus, (Table II) a comparison of health care facilities in 1970 and 1975 shows that there has been a 45% increase in the health care facilities of the Muda area (Singh, 1978). It would therefore seem that both a rise in the economic status of the people as well as an increase in health inputs have contributed to a decrease in mortality.

CONCLUSION

The Muda Irrigation Scheme illustrates that ecological changes can bring about both benefits as well as social, cultural and health problems consequent upon the destruction of traditional systems. Eisenstadt (1973) in his critical analysis of developing societies noted that "the mere

destruction of traditional forms did not necessarily assure the development of a new, viable, modern society, and very often the mere disruption of traditional settings — be they family, community, or even sometimes political settings — tended to lead to disorganization, delinquincy and chaos". Happily, the Muda shceme has not ended in chaos and so far as can be assessed the benefits outweigh the negative outcomes and the net result remains positive, at least from the point of view of mortality.

Table II
Health Facilities in the Muda Area, 1970 and 1975

Health Facilities	1970	1975
General Hospital	2	2
District Hospital	—	—
Main Health Centre	1	2
Health Sub-centre	8	11
Maternal & Child Health Clinic	2	2
Polyclinic	1	1
Community Nurse Clinic (Kelinik Desa)	—	7
Midwife Clinic	43	58
Total No. of Health Facilities	57	83

Source: Singh, A. (1978) Lapuran Kesihatan Kawasan MADA, 1970-1975.

SUMMARY

Major ecological changes have been introduced in the Muda Irrigation area. With double cropping and the associated use of fertilizers and pesticides, a 90% reduction in the number of fishes found in the padi fields has occurred. The rat population has increased while the buffalo, an important source of protein and an important cultural element in the cycle of life, has virtually been replaced by mechanised ploughs. The addition of 480 miles of farm roads has resulted in an increased number of deaths from motor vehicular accidents. The construction of about 1200 miles of canals has been associated with an increase in the number of enteric fever cases. However, general mortality at all ages has decreased. However, the decrease is most probably due to the combination of a 45% increase in health facilities in the Muda area and a rise in the economic status of the padi farmer in the Muda area.

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