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CAMBODIA:
AN ENVIRONMENTAL AND AGRICULTURAL OVERVIEW AND SUSTAINABLE DEVELOPMENT STRATEGY

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CAMBODIA: AN ENVIRONMENTAL AND AGRICULTURAL OVERVIEW AND SUSTAINABLE DEVELOPMENT STRATEGY*

Introduction

The forests, which help stabilize the soil and regulate the flow of water in Cambodia, are disappearing at an alarming rate. Once known for its fertile rice fields, rich fishing grounds, lush forests, and abundant wildlife, Cambodia is now suffering severe environmental degradation and food shortages resulting from the policies of the despotic Khmer Rouge regime, the inept and corrupt Vietnamese-installed current regime, the ravages of war, and plunder by its neighbors and outsiders.

Prior to the take-over by the communists in 1975, it was estimated that over 70% of Cambodia was covered with forests, but now Cambodia's Forestry Department estimates the cover at 40%. Furthermore, approximately 40% of the watershed** of Tonle Sap Lake has been deforested and the fish production from the lake reduced by approximately half.[1/] Fish and other aquatic life are the main source of protein for Cambodians, and it's estimated that over 30% comes from one source--Tonle Sap Lake. Rivers and lakes are silting up at an unprecedented rate, endangering many fish species as well as other aquatic life. Wildlife is also rapidly disappearing, since so many Cambodians have weapons and depend upon wildlife for sustenance.

Tonle Sap Lake is crucial to the well-being of not only Cambodia but of Viet Nam as well. It acts as a buffer or flood regulator of the lower Mekong Basin, drawing off water during the peak of the flood and adding it back later in the year. It also serves to limit salinity intrusion in the delta areas of Viet Nam and the waters draining from the lake are rich in nitrogenous products that provide food for the masses of marine life that aggregate every year off the coast of Viet Nam to feed in plumes of the Mekong and Bassac rivers.[2/]

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**The report did not distinguish between watershed and the "flooded forest" ("prey roniam") of Tonle Sap lake. This provides the estuary for the rich aquatic life in the lake. Most likely, flooded forest was meant, since Cambodian foresters do not use the term watershed when referring to the forests/trees around the lake, and since most of the water in the lake comes from the reverse flow of the Tonle Sap River rather from surrounding hills.

The single most over-riding deterrent to sustained environmental development and agricultural production in Cambodia is the saturation of the countryside with land mines. Until these mines are cleared and destroyed, effective development cannot take place. A.I.D. should immediately commit start-up funds and encourage other donors to join in funding international organizations for demining operations.

Deforestation

The total land area of Cambodia is approximately 181,000 km[2/]. Prior to the take-over by the communists in 1975, it was estimated that over 70% (12.67 million hectares) of Cambodia was covered with forests, but now it is estimated that only 40% (7.24 million ha) remain. FAO places the amount at 7.5 million ha.[1/] Very little was cut prior to the Khmer Rouge take-over in 1975, leading one to conclude that the most rapid depletion of forest resources has happened in the last 15 years.

In 1985, the Phnom Penh regime estimated that total wood and lumber production amounted to only 5,303,000 m^3/yr, of which 90% was consumed for fuelwood or used for charcoal production.[3/] One hectare of prime tropical forest is estimated to yield 30-40 m^3 of saleable timber. Total biomass in tropical forests may run as high as 60 m^3/ha. If the figures given by Phnom Penh are used and total biomass production at 60 m^3/ha, this would amount to a deforestation rate of only 80,808 ha/yr. This does not correspond to the discrepancy in the total forest cover before the war and now--indicating a deforestation rate of almost 360,000 ha/yr.

The Khmer Rouge, the Phnom Penh regime, the Vietnamese and Thais are all reaping considerable benefits from both legal and illegal logging operations. In exchange for foreign policy support from Thailand's former government, Thai commercial loggers with strong links to the military sought concessions from Cambodia for the cutting of 600,000 m^3 of round timber (equaling 20,000 ha of standing timber @ 30 m^3/ha)a year), more than double the forest reserves harvested in 1989.[4/]

The amount of deforestation caused by joint Khmer Rouge-Thai logging operations is difficult to assess. However, income from logging and gem mining is large enough to allow the Khmer Rouge to sustain military operations and political activities without further assistance from China.[5/]

Logs and lumber have been a form of payment for Vietnamese troops who fought in Cambodia and a means of repaying the Phnom Penh's debt to both Viet Nam and the Soviet Union for their extensive military assistance. About half the timber harvested in Cambodia

is taken by Vietnam. One 72,000-ha concession in Kracheh province alone exports over $3 million worth of logs at concessionary prices to Viet Nam each year. Thirty percent of the tropical hardwoods sawn at a Japanese-built mill near Phnom Penh is exported to the Soviet Union.

Recent Cambodian and Vietnamese emigrants to the U.S., as well as visitors to both countries, report that Vietnamese logging operations in the Eastern Zone of Cambodia are so extensive that logging trucks cause massive traffic jams on roads leading from Cambodia to Viet Nam.

Despite its "so called" official economic boycott, the Japanese funded mill outside Phnom Penh cuts and exports one-quarter of all of Cambodia's legally harvested valuable tropical hardwoods to Japan.[4/] Reportedly, most of the mill's profits are harvested by Prime Minister Hun Sen's wife. Japan has also funded a $5.5 million joint venture with Cambodia's forest and wildlife agency, planned for completion in May of 1991, that will process more wood products for export to Japan.[6/] In addition, Japan funded a similar $1 billion joint venture with Viet Nam on the border of Cambodia north of Saigon.[7/] If Viet Nam's illegal logging operations continue, a great share of the trees fed to this mill will be cut and exported from Cambodia's forests.

Though only one tree species, Hydrocarpus spp. ("kraban"), found in the flooded forest of Tonle Sap Lake is of significant economic importance for commercial exploitation,[2/] approximately 40% the forest has been destroyed. A major cause of this destruction is the settlement of large numbers of Vietnamese along the shores of the lake and their cutting of trees and shrubs for fuelwood and for the export of charcoal.

No doubt accelerated deforestation has greatly contributed to flooding in Cambodia.

Annual Flooding

Flooding in Cambodia, which began in August this year, reportedly left over 100 people dead and caused approximately $150 million in damage--$30 million to roads alone. According to Cambodia's Foreign Minister, more than 100,000 hectares of rice was destroyed (30% of the total).[8/]

Flooding is not abnormal, for it is the life blood of Cambodia. Approximately 2/3 of Cambodia's arable lands are flooded each year (about 2 million hectares) and the nutrients to grow much of the food in these areas comes from the silt-laden floodwaters of the Mekong and its tributaries.[2/]

Not only is Cambodia's rice production dependent upon the fertilizing effect of the floodwaters, but the life cycles of the vast majority of the fish in the lower Mekong river depend predominantly on the annual inundation cycle. About 90% of the fish in the Mekong system spawn not in the rivers themselves, but in adjoining lakes, submerged fields, or the flooded forest areas of the Tonle Sap Lake.

No doubt, flooding has increased in the past 15 years, since there has been wide-scale deforestation, and the "colmatage system," which helped check and dissipate flood waters, has fallen into disrepair and disuse. It is also reasonable to assume that part of the damage to the rice crop was a result of the planting of high-yielding IRRI rice varieties. Farmers planted these varieties upon the encouragement of donor agencies and the Phnom Penh regime. High-yielding varieties demand a rigid water regime while lower-yielding indigenous varieties are more tolerant to flooding.

Colmatage System

In the "colmatage" system, canals ("Prek") were dug through the natural levees of the rivers, which allowed flood waters to inundate the adjoining rice fields and drop their load of nutrient-rich silt to fertilize the next rice crop. The yields on these flooded fields were much higher than on unflooded rice fields.

Although the "colmatage" system constituted only about 15 percent of the total rice lands in Cambodia, it helped compensate for the ecological degradation resulting annual flooding and farming in the unflooded zones as they became more drought-prone and the soils more infertile. The "colmatage" system served three purposes. First, it helped syphon off water from flooding rivers in the rainy season, spreading it over low-lying rice fields and storing it in inland lakes and reservoirs, reducing damage that might otherwise occur if left uncontrolled. Second, the nutrient-rich silt-laden flood waters refertilized the relatively infertile adjoining rice fields for the next crop of rice. And third, it provided fertile waters in which fish and other aquatic life abounded.[2/]

The Khmer Rouge displaced millions of people from urban areas, villages, and irrigated farm lands to forested areas forcing them to clear new fields to plant rice and other food crops. Not only did this lead to widescale deforestation in these areas, but it resulted largely in the abandonment of the "colmatage" system of purposeful flooding of rice fields. In many of the areas formerly served by the "colmatage" system, the Khmer Rouge attempted to grow two crops per year by blocking the floodwaters from the fields altogether. This failed because the soils were soon rendered infertile and the floodwaters no longer reached inland lakes ("beng"), which provided water for dry season irrigation.

Even though the present Phnom Penh regime allowed the reopening of some of the canals through Western aid, production gains have been offset by the disincentives of collective farming and state ownership of lands.

Agricultural Production[2/]

Rice Production--Cambodia's main agricultural crop is rice. In 1985, agriculture in Cambodia accounted for 90% of the gross domestic product (GDP), and employed approximately 80% of the work force. Is is very difficult to estimate Cambodia's rice production today. The FAO estimated that rice production during the 1979-87 period did not reach the 1966 level of 2.5 million tons.[3/] This should come as no surprise, since over 1 million Cambodians were killed or died during the reign of the Khmer Rouge, almost half of the male population has been killed, there has been continuous war since 1973, much of the work force is in the army, many rice growing areas are mined, and the "colmatage" system that supported rice production has been neglected and has fallen to disrepair.

Cambodia's cultivated rice land can be divided into three areas: The first and richest (yields exceeding 1 mt/ha) covers the area of the Tonle Sap Basin and the provinces of Batambang, Kampong Thum, Kampong Cham, Kandal, Prey Veng, and Svay Rieng. The second (yields average 4/5 mt/ha) comprises Kampot and Koh Kong provinces along the Gulf of Thailand and some less fertile areas of the central province. The third (yields less than 3/5 mt/ha) comprises the highlands and the mountainous provinces of Preah Vihear, Stoeng Treng, Ratanakiri, and Mondol Kiri.[3/]

Principally, there are two rice crops a year: a monsoon-season crop (long-cycle), planted from late May through July, transplanted from late June through September, with the main harvest around December; and a dry-season crop (short-cycle), planted in November and harvested in January or February. The dry season crop averages about 15 percent of the total annual production. Additionally, around Tonle Sap Lake, floating rice is planted in April and May and harvested nine months later. The yield is low, less than half of other rice types.

According to a survey of paddy soils of tropical Asian countries, Cambodia's soils sampled were on the average the least fertile of all. A Japanese team of soil scientists described the Cambodian soils as weakly acid to neutral clayey loams with good nutrient retention capacity but deficient in nitrogen, phosphorus, and especially potassium. The Mekong River Water is slightly acid to alkaline and exercises a neutralizing influence on its silt load and the soils it floods, making them more favorable to plant nutrition. By contrast, annual applications of some chemical fertilizers can make some soils progressively more acidic, and this eventually lessens their productivity.

Rice production in Cambodia has evolved in harmony with nature, and considerable variation exists in the extent and duration of the annual floods, and in the beginning and consistency of the monsoon rains. A wide variety of rice has been traditionally used in Cambodia, each adapted to a particular set of soil and water conditions, with broader environmental tolerances than the newly introduced IRRI varieties. Within the zone of flooding, a short stemmed, modern variety is riskier to grow in the wet season than a tall-stemmed, traditional variety. Yet beyond the zone of flooding, soils tend to be infertile and rainfall unreliable. Here, too, the modern varieties prove riskier unless a stable environment can be ensured through the use of water control, irrigation and fertilizer.

The average farmer plants rice on fields that often span at least two different sets of soil and water conditions and often grow several varieties within each set of conditions. This practice diminishes risk, for farmers in rain-fed areas frequently face the problem that rains come late or start, and then stop, for several weeks. Most varieties traditionally grown in Cambodia mature in 150 days or more. If the rains are sufficient, the farmer can transplant seedlings when they are 30 to 35 days old, or if necessary, hold them for as long as two months without yield reduction. IRRI varieties, which mature in less than 130 days, are much more sensitive to stress, and if rains are delayed and the farmer cannot transplant on schedule, the yield will be greatly reduced.

With the IRRI rice varieties, a mimimal amount of energy is consumed in stalk development and much more goes into grain production. Traditional varieties grow much taller stalks and yields are much lower. However, through the use of Khmer rice accessions returned from the International Rice Germplasm Center in the Philippines, yields of some local varieties are projected to be improved by 20-30% by using pure-line selection methods.

By 1982, IRRI varieties amounted to only 4.1% of the annual crop. Some farmers were delighted with the IRRI variety IR36, which gave yields of about 3 mt/ha, but on poorer soils some crops of IR36 were hardly worth harvesting. This was especially true on the sandier and less fertile soils increasingly distant from the main rivers. These soils are more prone to drought, and if chemical fertilizer is added, it is rapidly leached from the root zone of the rice plants.

The introduction of new rice varieties must proceed cautiously, for it is important not to replace the risk-minimizing and location-specific diversity of the traditional varieties with a system that relies on only a few relatively stress-sensitive modern varieties. It is crucial that the effort to create an

improved water control system required by the modern rice varieties through the building of dams and levees does not undermine the natural renewal of soil fertility within the zone of flooding. High-yielding varieties result in the rapid depletion of soil nutrients. Unless steps are taken to renew these through a program of organic cycling or the use of chemical fertilizer, soil fertility will be dramatically lowered and the initial increase in production will not be sustained.

It is dangerous to adopt a policy of attaining food self-sufficiency by implementing a Green Revolution rice technology strategy requiring costly petrochemical imports and a high level of water control that is incompatable with the annual flooding regime found in Cambodia. At present, less than 10% of Cambodia's agricultural producers have access to land with sufficient water control required by high-yielding rice varieties. It is both costly to the farmers to purchase expensive fertilizers, pesticides, fuel oil for irrigation pumps, etc., as well as to the government in terms of scarce foreign exchange.

Such a policy also demands that appropriate infrastructures be in place before such a Green Revolution can take place; i.e., adequate amounts of foreign exchange to purchase expensive imports, transportation systems to deliver commodities to the rural areas as well as transport rice surplus to rice-deficient areas and ports of export, available credit in the rural area, rice storage facilities, rice pricing, and appropriate technology packages with extension services. These will not be available in the near term in peacetime Cambodia.

The availability and use of adequate numbers of draft animals, combined with the use of small farm machinery, is very important if rice production is to be increased in Cambodia; however, farmers cannot effectively and efficiently cultivate their land until the fields, dikes, pathways, roadways, etc., are free from mines and other booby traps.

Livestock Production--Water buffalo and oxen have traditionally played a crucial role in Cambodia in preparing rice fields for cultivation. In 1967, there was an estimated 1.2 million draft animals.[37] In fact, Cambodia was a major exporter of these animals to other regions of Southeast Asia. By 1979, this number was estimated to have decreased by 50% because the animals were killed by warfare, eaten by peasants during famine and by Cambodian and Vietnamese troops, or rustled and sold in neighboring countries. Though, pigs, sheep, goats, chickens, ducks and other small livestock are also an integral part of farm production, fish and fish products and other aquatic life provided most of the protein intake by Cambodians.

Secondary Crops--Rubber has been Cambodia's most important export crop; however, many plantations were destroyed during the war and production fell sharply. Reportedly, Viet Nam assisted Cambodia in re-establishing some plantations and in restorating some rubber processing plants. The Soviet Union has been a major customer, purchasing over 10,000 tons of natural rubber in 1986. Other secondary crops include maize, cassava, sweet potatoes, groundnuts, soybeans, sesame seeds, dry beans, coconut, sugarcane, cotton, tobacco, jute and sugar palm.[3/]

Sugar palms ("dam tnot") are very symbolic to Cambodian culture and are an integral part of rural life. They serve as a resource for the production of sugar as a cottage industry in rural and urban Cambodia--both for home consumption and for sale, for the production of homemade wine, for thatch for housing, and for handicrafts. According to reports, a large number of these trees were destroyed during the war and many were cut down as a source of fuelwood.

Vegetable Production--Vegetables are traditionally grown during the dry season on lands flooded during the monsoons. However, unprecedented deforestation, the disruption of the flooding cycles and siltation of rivers have resulted in a decreased vegetable production in traditionally vegetable growing areas, such as in the Prek Ta Tam area.[10/] In the postwar reconstruction, it will be important to revitalize this sector in order to increase the nutritional intake of Cambodians and provide a source of income for the disadvantaged. Technical assistance in home gardens will be extremely important, especially to aid returning refugees, widows and unmarried women and their families, and war causalties because of under- and unemployment and these people's inability to do the heavy labor required in rice farming. Reportedly, 73% of the adult population in Cambodia are women.

Fuelwood and Charcoal--The cutting of forested areas for fuelwood and charcoal has been a major cause of deforestation in some areas, especially in the Tonle Sap Lake "flooded forest." It has also been a major contributor to deforestation around populated areas. This problem is exacerbated by reduced petroleum imports. As a result, large trucks are sent to rural areas and massive amounts of wood are trucked to and sold in the cities and towns both for cooking and for small scale industries.

Fuelwood production using fast-growing trees can be an important economic crop in the postwar reconstruction of Cambodia and can contribute greatly to slowing down deforestation. Fuelwood and charcoal will continue to be used as a primary source of fuel in both rural and urban Cambodia.

Land Ownership, Collectivization and Solidarity Groups

Under communist rule in Cambodia, most of the land was placed under state ownership and farmed collectively by small solidarity groups. However, it is reported that the present regime has begun privatizing some of the land by distributing the best parcels to party hacks and cronies (and to Vietnamese), similar to what took place under the Sandinista regime in Nicaragua.

Under the present regime the agricultural sector was collectivized and the rural population organized into solidarity groups, known as "peasant labor associations," each later to comprise 7 to 15 families. Over 97% of the rural population was organized in this manner.[3/]

In theory, each solidarity group received 10 to 15 hectares, the members of which "owned" the land and received the "benefits of their labor." The land was cultivated collectively and the harvest divided among member families according to the amount of labor contributed by each family, with a special allowance to those who were unable to contribute labor to farming, such as the elderly, the sick, nurses, teachers and administrators.

Farm animals and implements were also collectivized, although purportedly these were only "lent" for solidarity group use. Each family member of a solidarity group was entitled to a private plot of land between 1,500 to 2,000 m^2 and allowed to till it when not working for the collective farm. The state had the sole right to purchase the harvest produced by the associations, but the harvests from private plots were to remain the property of the producers, who could consume, barter or sell it.

Fisheries[2/]

Fish and other aquatic life is the main source of protein for Cambodians, and it's estimated that over 30% comes from one source--Tonle Sap Lake. The flooded rice fields, small lakes and reservoirs, irrigation canals, and rivers abound in a variety of fresh water shrimp and fish, crabs, frogs, etc., much of which is dried or processed into sauce ("toek trey") or paste ("prahoc"). Fish, fish products or aquatic life are eaten at almost every meal.

Deforestation and the disuse of the "colmatage" system are having disastrous effects on fisheries in Cambodia. It is reported that siltation of the lower part of the Mekong River and of the Ta Tum estuary in the area of Prek Ta Tum has resulted in the disappearance of one commercial species of fish, *Caticarpio siamensis* ("kol raing," ver.), from the fishermen's catch. One observer believes that due to the siltation of the area, the fish was no longer able to migrate to spawn.[10/]

Not only is the production of Tonle Sap Lake threatened by deforestation of the flooded forest (estimated 40%), but several other problems are present or loom on the horizion. Raw sewage from the city of Phnom Penh threatens the annual migration of fish from the Mekong up to the lake. Overfishing has been a problem in the past, and it has increased due to the large numbers of Vietnamese that have settled on the lake's shores. One of the most intractable, long-term problems is the gradual silting of Tonle Sap Lake. A reasonably large lake area must remain throughout the dry season if there are to be sufficient "black fish" to populate the flooded forest in the wet season. In the 1960s it was suggested that the half-life of the lake was about 900 years. However, accelerated deforestation of the Mekong watershed in the past few years has greatly increased the siltation rate.

According to official records, the registered catch in 1982 amounted to 74,200 tons of fish of which approximately 93% came from inland sources; i.e., lakes, streams, rivers, reservoirs and flooded rice fields. Much of the seafood, such as shrimp and lobsters (crayfish), are exported under contract at concessionary prices to Thailand, Japan, Viet Nam and the Soviet Union.

Tonle Sap Lake

The heart of Cambodia's productivity is Tonle Sap Lake, which must be protected at all costs, for it is one of the country's most valuable resources. Once one of the richest inland fishing lakes in the world, Tonle Sap was reported as being nearly ten times as productive as the best fishing grounds in the North Atlantic. Fish yields are at least 65 kg/ha/yr in the lake if calculated on the basis of the dry season area of the lake. This compares to an average yield of 12 kg/ha/yr in tropical rivers, and 32 kg/ha/yr in intensively managed reservoirs in Thailand. The lake is rich in nutrients, and it is thought that because of this, fish almost double in size growing in the lake as compared to those reared in the Tonle Sap River.

The lake not only is important to fishing in Cambodia, but it serves Viet Nam as well. Every year, the lake generates large quantities of nitrogenous products that are flushed when the flow of the Tonle Sap River is reversed, thus providing abundant food for the masses of marine life that aggregate every year off the coast of Viet Nam to feed in plumes of the Mekong and Bassac rivers.

Due to deforestation, spawning areas are being destroyed at an alarming rate and it is reported that some species of fish have disappeared.10/ The flood waters of the Mekong river actually reverse the flow of the Tonle Sap River, which both feed and drains Tonle Sap Lake. The river generally stops flowing downstream in early June and flows inland about 110 days a year

from mid-June to early October. During this time the surface area of the lake decreases to approximately 1 million ha.

There is an estimated 750,000 hectares of "flooded forest" ("prey roniam") around Tonle Sap Lake, a unique natural resource essential to the high productivity of Cambodia's inland fisheries. Flooded from around June to October, it rims the lake with a 30-40 km wide strip of shrubs and small trees.

At least 16 species of fish inhabit the lake, and Cambodians group them into two categories--white fish ("trey sau") and black fish ("trey kmao'), comprising carp (54%), catfish (19%), and murrel (9%), with herring, climbing perch and gourami among the remaining 18%. The white fish are intensely migratory, and the most ecomonically important include three carps and five river catfish, the largest of which can weigh about 300 lbs. The most economically important black fish include two carnivorous murrel, a climbing perch, and a fourth species Oxyeleotris marmorata. The black fish do not migrate from the flooded forest when the water level first drops, and the murrel and climbing perch can travel appreciable distances over wet land since they are adapted to breathe in low-oxygenated water found in small puddles.

Proposed Dams

The Pa Mong hydroelectric dam across the Mekong River between Thailand and Laos, proposed by the Mekong Secretariate would reduce both the amount of nutrient-rich silt deposited on the rice lands as well as the duration of the annual flooding by at least 15%. It would remove from the flood zone about 184,000 hectares around the Tonle Sap and a further 200,000 hectares along the Mekong and Bassac rivers. Even though the dam would offer more control of the naturally violent water regime and allow for more intensive cropping of some areas,[2/] it would also increase the extent of drought-prone areas, decrease soil fertility and destroy much of the estuary in the lake, thus adversely affecting fish production.

Furthermore, the dam planned by the Mekong Committee in the 1960s for construction at the mouth of Tonle Sap Lake would be disastrous. Supposedly, it would raise the dry-season level of the lake by two meters; in fact, it would not only lower the fish production by reducing the area of the "flooded forest," but it would severely endanger those species of fish that migrate to and from the lake, which is necessary for reproduction. Additionally, it would prevent the annual nutrient flush from the lake that so much of the aquatic life at the mouth of the Mekong River depend upon.

Mines[11]/

With an estimated population of 8.5 million, Cambodia has the highest number of mine amputees of any country in the world--with over 30,000 amputees in Cambodia and 6,000 in the border camps. In 1990 alone, at least 6,000 Cambodians suffered shattered limbs and amputations as a result of land mines. Most of the casualties are peasants who step on mines while farming, herding or fishing. Unless these deadly mines are cleared and destroyed, they will kill or maim Cambodians well into the next century and severely impede development in the countryside.

Mine accidents now rank with malaria and tuberculosis as one of Cambodia's three greatest public health hazards. Most of the mine amputees leave the hospital without artificial limbs and return to their villages with little hope for useful future lives. The amputees are often viewed by their families and communities as simply another mouth to feed that produces nothing, causing them to turn to begging or petty thievery.

Modern land mines often have non-metalic casings that render the usual mine-detection gear all but useless and have camouflaged casings that make them hard to see. Once peace arrives, tens of thousands of Cambodians will leave displaced persons' camps inside the country, and others will come from the Thai border camps, returning to villages and farms riddled with mines.

RECOMMENDATIONS

The stagnation of the economy and productivity in Cambodia is due to the devastating war over the last 20 years and the 16 years of communist rule in which a great share of the educated and productive forces either were killed or fled the country. Therefore in order to accelerate the rebuilding of Cambodia, it is imperative that Cambodians with professional and technical skills who live in other countries be brought back to participate in its development. This will necessitate the incorporation in the design of development projects the requirement that funded positions be filled by the solicitation of professionally and technically qualified persons of Cambodian descent if available. This should especially be a requirement of all projects and programs funded by the United States, including those carried out by private voluntary agencies.

Presently, one of the greatest deterrents to development in Cambodia is the plethora of mines strewn throughout the country. Thus, the de-mining of resettlement and farming areas should have the highest priority.

It is estimated that women constitute 73% of Cambodia's population,12/ and there are over 36,000 amputees, not counting other war wounded, and a great share of the remaining population are children; therefore, many of these people will not be able to do the heavy work required in rice farming and other agricultural sectors. In 1985, agriculture employed approximately 80% of the work force. Thus, particular attention will have to be made to provide training and other resources for these people in order for them to earn a livelihood.

This lends itself to inumerable development initiatives that should begin immediately after the election of a new democratic government, which include:

1. <u>De-Mining</u>--The first priority for A.I.D should be to immmediately commit start-up funds to international humanitarian organizations to carry out a detailed, province-by-province mine survey. Mine-supplier nations should provide technical information and advisors to help clear mines from the countryside. Professional de-miners should be hired to locate the most heavily mined areas, seal them off, and clear the mines. Other donor agencies and countries should be encouraged to help fund this activity.

2. <u>Donor Agency Coordination</u>--A commission must be established to coordinate donor aid to ensure effective use of development resources. It is suggested that a national development agency be set up much like the highly successful Joint Commission Rural

Reconstruction (JCRR) funded by A.I.D. during Taiwan's early stages of development.[13/] JCRR was set up as an internal development aid organization to develop, coordinate and implement a strategy for the development of Taiwan. The JCRR would be a excellent model to be emulated for development in Cambodia. (A detailed report on JCRR is available from the author of this paper.)

3. Property Rights and Dispute Adjudication--In order to promote and enhance investment in Cambodia, it is imperative that the new government immediately set up an unbiased commission that will have the authority to establish clear property rights and to fairly adjudicate disputes. Without this, Cambodia will follow in the footsteps of Poland and other former communist countries and fail to attract investors.

4. National Agriculture Strategy--Cambodia's new government must also develop and implement a nation-wide strategy to increase agricultural production and self sufficiency on a sustainable basis. This strategy must also be complemented with supportive policies, such as pricing, that will also be implemented by the government. The strategy must be cost-effective and based on both traditional and introduced improved rice varieties; animal and mechanical power; chemical fertilizers, recycling of organic wastes, and the fertilizing value of flood and irrigation water; and the necessary supportive infrastructure to deliver the necessary commodities. Furthermore, the appropriate government agencies must be staffed with adequately trained personnel to carry out the above.

It is dangerous for Cambodia to adopt a policy of attaining food self-sufficiency through a Green Revolution rice technology requiring costly petrochemical imports and a high level of water control that is incompatable with the annual flooding regime found in Cambodia.

5. Commission for Land Redistribution--In order to stimulate agricultural production in Cambodia, it is imperative that an unbiased Commission, composed of multi-party representatives, be set up by the new "democratically elected" government to redistribute state land and the land that was given to "privileged members and friends" of the current regime. This land must be redistributed on the basis of size (large enough for economical farming under Cambodian conditions), provable former ownership, previous farming experience and need.

6. Farmers' Cooperatives--In order to have the means to farm, it will also be necessary to redistribute collectivized farm animals (especially water buffalo and oxen) and farm implements. Since these were appropriated by the communist state and true ownership

would be extremely difficult to determine, a fair means of redistribution would be to turn these over to cooperatives, supervised by the above proposed Joint Commission on Rural Reconstruction (no. 2) but run by the farmers. The animals and machinery should be sold to cooperative members at a fair price through "soft loans."

The money from the loan repayments should then be used for the purchase of other needed materials to be sold to farmers (either with cash or through loans), and for loans for cottage industries and other farm-based enterprises. The commission should have the wherewithall to set up cooperatives, train members in cooperative administration, and set them up as profit making enterprises. Women and war victims should be given special consideration in this type of a project.

7. Private Sector Small-Scale Enterprises--Since agriculture in Cambodia accounted for 90% of the gross domestic product (GDP) in 1985 and employed approximately 80% of the work force, there is a great need to stimulate agricultural production. To do so, it will be necessary to complement traditional agricultural technologies with more modern mechanization.

Therefore, it will be necessary to have a program that would fund, through loans, the setting up or improvement of small farm machinery industries, such as those implements developed at IRRI in the Philippines for rice including hand-held tractors. Traditionally, water buffalo and oxen have been the principal source of traction to cultivate the fields in Cambodia; however, a great many were either killed or died during the war. Therefore, small hand-held tractors must be made available to farmers to make up for the loss of animal power. To make this program work, it is imperative that affordable fuel be readily accessible to the farmers, which would be possible through the farmers' cooperatives suggested in no. 6 above. The program should initially emphasize the production of farm machinery, but include the funding, through loans, of other small and medium scale enterprises and cottage industries in the private sector. Again, women and war victims should be given special priority.

8. Moratorium on Export of Natural Resources--A moratorium should immediately be placed on the export of all natural resources, such as wood products and fresh water fish and seafood, until a strategy for the sustained management of these resources can be developed and enforced. I assume that a Ministry of Natural Resources will be part of the new government, and it would be charged with the development of such a strategy.

For those renewable resources deemed harvestable on a sustained basis, all export contracts should be fairly adjudicated and

renegotiated, so that they are not sold at concessionary prices, and profits going to individuals without legal and fair ownership or to people engaged in unfair business practices. Simultaneously, a system must be established to ensure that a "fair tax revenue" be returned to the government.

Environmentally Sound Oil Exploration--Since great interest has been shown by U.S. companies as well as those of other nations in off-shore oil exploration in Cambodian territory, a national policy should be developed to set environmental guidelines and standards for the exploration and development of this resource. This should also include environmental assessments of the drilling, processing and shipping sites. Much of the drilling will take place in environmentally unique and fragile areas such as island ecologies. Perhaps the standards and environmental assessments developed by the U.S. government in cooperation with U.S. oil companies and the environmental community could serve as a model.

9. Ecological Reserves--A number of ecological reserves and parks must be set aside to protect Cambodia's unique flora and fauna and a strategy devised to harvest the resources in them on a sustainable basis. The highest priority should be given to Tonle Sap Lake, which should be declared an "ichthyological reserve" and a project should be launched to restore and protect its "flooded forest." This does not mean that farming and the harvesting of fish and other wildlife should be banned from this area, but it does mean that these activities need supervision to ensure that these activities do not damage the ecology, and that resources are harvested on a sustainable basis.

Search for the Kouprey--The World Wildlife Fund International (WWFI) already has a memorandum of understanding with the present governments of Cambodia, Viet Nam and Laos on the conservation and preservation of the kouprey (*Bos sauvli*, also called *Novibos sauveli*). The kouprey is thought to be native only to Thailand, Laos, Cambodia and Viet Nam. In 1964, the kouprey was named Cambodia's national animal and is thought to be near extinction or perhaps extinct. The last known sighting of kouprey was in 1982 in Thailand, near its borders with Cambodia and Laos. The kouprey's range is thought to cover the areas along both sides of the Mekong River in northern Cambodia, the Dangrek Range and other parts of eastern Thailand to the most southern part of Laos, and to the westernmost part of Viet Nam.[14]

WWFI's efforts to search for and conserve the kouprey in Cambodia should be supported by A.I.D., perhaps channeled through R&D/ENR's Biological Diversity Project with World Wildlife Fund (U.S.), and an all-out effort should be made by the new government to facilitate this activity. Also, there is a network of U.S. zoos that have expressed interest carrying out a captive breeding

program in support of WWFI's efforts. The kouprey is the most primitive of living cattle and is thought to have natural immunity to the rinderpest disease, which causes the deaths of tens of thousands of cattle in Africa. If the kouprey can be found and captured, and it is found to have this natural resistance, it could make an important contribution to another A.I.D. project attempting to develop a vaccine against rinderpest.

10. Moratorium on the Construction of Dams--A moratorium must be placed on construction of all dams on the Mekong River network in Southeast Asia until detailed environmental assessments are made by credible international environmental organizations. The assessments must include: (a) the effects of the loss of the nutrient-rich, silt-laden flood waters and water cycles to sustained rice production in Cambodia; (b) the disadvantages or advantages of increasing water levels in Tonle Sap Lake by a dam in relationship to fish and rice production and the seasonal flush of the nutrients from the lake necessary to sustain fish and other aquatic life at the mouth of the Mekong and Bassac rivers; (c) the effects on fish and other aquatic life on spawning and production in rivers, reservoirs, lakes, rice fields and coastal areas (mouth of the Mekong); and (d) the effects the salinity of agricultural lands and water in Cambodia and Viet Nam.

11. Engineering Projects--Besides the clearing of mines, several other important engineering projects are needed to support agricultural development, improved public health, and the preservation of the biological diversity of Cambodia. These include: (a) The reconstruction of the former "colmatage" system so that environmentally sound and sustainable agricultural and fish production can be re-established; (b) installation of an environmentally sound sewage and waste disposal systems for major population centers (this effort must be coordinated with public health efforts), beginning with Phnom Penh, where sewage is put directly into rivers, a threat not only to public health and but to fish production in the Tonle Sap as well;[2/] and (c) the dredging of silt-choked rivers and canals, which is affecting the spawning of fish, such as at Prek Ta Tum, where it is reported that the species *Catlacarpio siamensis* ("kol raing" ver.) is endangered.[10/]

12. Home Gardens and Vegetable Production--A home garden and vegetable production project would be very valuable for providing income and increasing the nutritional intake in peacetime Cambodia. Vegetable production, food processing and preservation, and marketing can provide a great many jobs for women, war victims and children.

The Asian Vegetable Development Center in Taiwan would be the natural A.I.D.-assisted International Agricultural Research Center

to provide the technical assistance for such a project. The project should include small loans for the purchase of necessary materials for vegetable farming and food processing. It should focus not only on vegetables, but also on: growing multipurpose, fast-growing and nitrogen-fixing trees and shrubs for the homesite and on-farm production of fuelwood, forage, fertilizer and pesticides (the neem tree can be used to produce the latter two); and the micro-production of sugar palms, fruit trees and shrubs with leaves and fruits high in vitamins essential for good health, such as A & C (A-"chaya," Cnidoscolus chayamansa); C- West Indian cherry, Malpighia punicifolia L.).

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