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Appendix A

Estimating Procedures

Eight-Month Food Need

The food need for the 1 April-30 November period of 645,000 tons of milled rice or its caloric equivalent was derived on the basis of the following assumptions and calculations:

- A population of 5.2 million people.[3]
- A ration yielding 1,800 calories per person per day.[4]
- An estimated 3.54 million calories per ton of milled rice.[5]
- A 244-day feeding period.
- No losses from spoilage, pests, and other causes, and no diversion of food to Vietnamese military personnel, or shipment of food to Vietnam.

The computation of food needs involves taking the number of calories per ton of milled rice (3,540,000) and dividing by 1,800 calories per ration to obtain the number of rations (1,966.67) per ton of milled rice; dividing the number of rations per ton of milled rice into the number of people to be fed each day (5,200,000) to obtain the daily milled rice requirement (2,644 tons); and multiplying that requirement by the number of days in the feeding period (244) to obtain a total need of 645,136 tons of milled rice.

[3] We have estimated that, as of 1 December 1979, Kampuchea's population was somewhere between 4.7 million and 5.5 million, with the most likely estimate being 5.2 million (see appendix C).

[4] Selection of an 1,800-calorie ration was based on several factors:

- Indications that World Food Program plans to provide refugees on the Thai-Kampuchean border with a rice ration yielding 1,770 calories per person per day.
- The Asian Development Bank's report *(Asian Agricultural Survey 1976)* that indicated a daily per capita intake of 1,780 to 1,940 calories in Indonesia, Bangladesh, and the Philippines provided only 80 to 86 percent of energy requirements.

[5] Alan Berg, in *The Nutrition Factor* (Brookings Institution, 1973), cites an estimated 354 calories per 100 grams (3.54 million calories per ton) of milled rice. The Food and Agriculture Organization's (FAO's) *Agricultural Commodities—Projections for 1970 and 1980* (Rome, 1971) gives a figure of 360 calories per 100 grams (3.60 million calories per ton) of rice—type unspecified. The figure explicitly associated with milled rice was selected for use here.

Dry Season Rice Crop

The estimate that the dry season rice crop will yield rations for only 21 days is based on the following assumptions and calculations:

- An area of 80,600 hectares planted in dry season rice.
- A yield of 1 ton of paddy rice per hectare.[6]
- A milling conversion rate returning 0.7 ton of milled rice from 1 ton of paddy rice.[7]
- A daily milled rice requirement for the country of 2,644 tons.

The computation for converting the dry season rice crop to days of rations involves multiplying the area planted (80,600 hectares) times the 1 ton per hectare yield to obtain output in terms of paddy rice (80,600 tons); multiplying the paddy output by the milling conversion rate (0.7) to obtain output in terms of milled rice (56,420 tons); and dividing the milled rice output bv the daily milled rice requirement (2,644 tons) to obtain the number of days the output will last (21.34).

Seed and Planting Area Requirements

The estimate that 103,000 tons of seed will be needed to plant 1.48 million hectares to rice in 1980 is based on the following assumptions and calculations:

- There will be a need for 965,000 tons of milled rice to feed Kampuchea's 5.2 million people in the year starting 1 December 1980 and ending 30 November 1981 (365 days times 2,644 tons of milled rice per day).

[6] Data indicate that Kampuchean yields averaged about 1.2 tons of paddy rice per hectare during the 1950s and 1960s, ranging from 0.978 tons per hectare (t/ha) for the 1966-67 harvest to 1.551 t/ha for the 1969-70 harvest—a year noted for exceptionally favorable weather conditions. The yield for the 1979-80 harvest was reported to have averaged less than 1.0 t/ha by the Kampuchean Agriculture Ministry at the end of January 1980.

[7] Reported milling conversion rates in Kampuchea vary from a low of 0.52 to 0.75 or more. An American agricultural economics adviser working in Kampuchea in the early 1960s reported that village mills then returned 55 kilograms of rice from an input of 80 kilograms of paddy rice—a 0.69 milling conversion rate. Rates of 0.60 to 0.74 were indicated for other mills.

Table 1 Tons

Milled Rice Required Per Day Under Varying Assumptions as to Population Size and Caloric Intake Per Person [1]

Population (millions)	Calories Per Person Per day									
	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100
4.0	1,356	1,469	1,582	1,695	1,808	1,921	2,034	2,147	2,260	2,373
4.1	1,390	1,506	1,621	1,737	1,853	1,969	2,085	2,201	2,316	2,432
4.2	1,424	1,542	1,661	1,780	1,898	2,017	2,136	2,254	2,373	2,492
4.3	1,458	1,579	1,701	1,822	1,944	2,065	2,186	2,308	2,429	2,551
4.4	1,492	1,616	1,740	1,864	1,989	2,113	2,237	2,362	2,486	2,610
4.5	1,525	1,653	1,780	1,907	2,034	2,161	2,288	2,415	2,542	2,669
4.6	1,559	1,689	1,819	1,949	2,079	2,209	2,339	2,469	2,599	2,729
4.7	1,593	1,726	1,859	1,991	2,124	2,257	2,390	2,523	2,655	2,788
4.8	1,627	1,763	1,898	2,034	2,169	2,305	2,441	2,576	2,712	2,847
4.9	1,661	1,799	1,938	2,076	2,215	2,353	2,492	2,630	2,768	2,907
5.0	1,695	1,836	1,977	2,119	2,260	2,401	2,542	2,684	2,825	2,966
5.1	1,729	1,873	2,017	2,161	2,305	2,449	2,593	2,737	2,881	3,025
5.2	1,763	1,910	2,056	2,203	2,350	2,497	2,644	2,791	2,938	3,085
5.3	1,797	1,946	2,096	2,246	2,395	2,545	2,695	2,845	2,994	3,144
5.4	1,831	1,983	2,136	2,288	2,441	2,593	2,746	2,898	3,051	3,203
5.5	1,864	2,020	2,175	2,331	2,486	2,641	2,797	2,952	3,107	3,263
5.6	1,898	2,056	2,215	2,373	2,531	2,689	2,847	3,006	3,164	3,322
5.7	1,932	2,093	2,254	2,415	2,576	2,737	2,898	3,059	3,220	3,381
5.8	1,966	2,130	2,294	2,458	2,621	2,785	2,949	3,113	3,277	3,441
5.9	2,000	2,167	2,333	2,500	2,667	2,833	3,000	3,167	3,333	3,500
6.0	2,034	2,203	2,373	2,542	2,719	2,881	3,051	3,220	3,390	3,559

[1] Based on 3.54 million calories per ton of milled rice.

NOTE: Values for populations and caloric levels not shown in the table may be determined by multiplying: 0.282486 times population in millions times calories.

The magnitude of the problem confronting Kampuchea is clear: almost 750,000 tons of food and seed will have to be obtained to feed the people until the next harvest and ensure the planting of an adequate crop to be harvested at the end of 1980. Where and how such a quantity of food and seed can be secured is less clear. A total of 456,000 tons of food would be available if the dry season harvest does in fact yield 56,000 tons of milled rice, if the international agencies deliver the currently proposed 250,000 tons of food, if the USSR and Soviet bloc countries deliver 130,000 tons of food as indicated by one recent report, and if private agencies are able to supply 20,000 tons of food. This amount of aid, providing rations averaging only 1,272 calories per day for each Kampuchean, would still leave the country short 189,000 tons of food. A shortfall of deliveries of 26,000 tons or more would lower the caloric value of an average ration below the starvation-diet level of 1,200 calories per person per day.

The acquisition of sufficient rice seed is fully as important as acquiring sufficient food. In the absence of a good harvest at year's end, Kampuchea will again be faced with food supply problems in 1981. The international agencies are currently considering provision of 40,000 tons of agricultural assistance in the form of seed, fertilizer, pesticides, and equipment. Even if this aid delivery consisted of only rice seed, more than 60,000 tons of seed would still have to be secured. If an area commensurate with 60,000 tons of seed is not planted this year, a 1981 food supply shortage on the order of 600,000 tons of milled rice should be anticipated.

Numerous reports have indicated that the food supply problem in Kampuchea has been lessened by the movement of food into the country across the Thailand-Kampuchea border. While the reports are undoubtedly true, the cross-border feeding program is nothing more than another means of distributing food aid; it does not alter the number of people to be fed or reduce the total food requirement. Only deaths and emigration can decrease the number of people in the country to be fed. In addition, the cross-border feeding program must be funded and provided with supplies for distribution just as are the programs that send food into Kampuchea via the ports at Kompong Som and Phnom Penh.

As of mid-March, the assistance plans noted here had not been confirmed, funded, or put into operation. Nor had there been any announcement by the Heng Samrin government concerning output from the dry season rice crop, the harvesting of which was reported to be under way in mid-February. Thus, while the assistance plans and the dry season crop hold promise of considerable relief for Kampuchea, the outlook remains grim for that country's food and seed supply situation.

Preface

In support of planning for UN conferences on Kampuchea, this report forecasts the magnitude of the food shortage confronting that country this year. It estimates the amount of food and seed rice the country will need, taking into consideration the likely effect of the dry season rice crop. Appendix A describes the methodology employed to derive the estimates.

The estimates are, of necessity, based on assumptions concerning the size of the Kampuchean population, the caloric intake required to sustain the population, and rates of seeding, milling, and yield. The assumptions themselves are based on recent analyses, historical data, and statements broadcast by the Phnom Penh government. Tables containing alternative estimates based on differing assumptions are included in appendix B. Small changes in assumed values, however, will not significantly affect the basic conclusion that the Kampucheans will need a considerable amount of assistance if a recurrence of famine conditions is to be averted.

		Executions begin.	Assumed 25,000 executed.	Assumed 50,000 executed.
		Kampuchean refugees begin to flee to Vietnam.	*Assumed no refugees to Vietnam.*	*Assumed 30,000 fled to Vietnam during 1975-79 from* new people *population.*
				Assumed 3,000 refugees to Vietnam.
1 Jul 75–1 Jan 76	Second forced displacement, included both *old* and *new people.*	Famine occurs in some areas; no medical care; incidence of malaria, dysentery, and other diseases increasing. Extremely hard work required by all.	*Old people*: assumed 30-percent drop in crude birth rate. Assumed crude death rate rose to 25 per 1,000 (UN estimated 1950-55 level).	
			New people: assumed same number died in this period as died in previous period. Crude birth rate 50 percent of *old people*'s rate.	
			Assumed 20,000 new people *fled to Thailand between July 1975 and January 1979.*	*Assumed 55,000* new people—*21,000 to camps, 8,000 illegals, and 26,000 died in attempt—fled to Thailand between July 1975 and January 1979.*
		Refugee flight continues to Vietnam and begins to Thailand.	Assumed 5,000 refugees to Thai camps.	Assumed 5,000 to Thai camps, 5,000 illegals, 10,000 died in attempt.
				Assumed 5,000 refugees to Vietnam.
		More executions.	Assumed 10,000 executed.	Assumed 30,000 executed.
1 Jan–1 Jul 76	Meager rice harvest. Khmer Rouge firmly in control of population.	Food rations above starvation level and most people sheltered. Unrelenting hard work on inadequate diet and lack of basic medical care, disease spreads among weakened populace.	*Old people:* crude birth and death rates from previous period remain constant.	
			New people: crude birth rate declines a further 33 percent.	
			Crude death rate double *old people's* rate, about 2.5 percent of population died.	Assumed 4 percent of population died.
		Refugee flight continues.	Assumed 3,000 refugees to Thai camps.	Assumed 3,000 refugees to Thai camps, 2,000 illegals, 3,000 died in attempt to escape.
				Assumed 5,000 refugees to Vietnam.
		More executions.	Assumed 10,000 executed.	Assumed 10,000 executed.
1 Jul 76–1 Jan 77	Food again in short supply.	Famine again occurs in some areas; disease spreads among total population.	*Old people:* crude birth rate declines 6 percent. Crude death rate remains constant.	
			New people: crude birth rate remain constant.	
			Crude death rate remains constant.	Assumed 4 percent of population died.
		Refugee flight continues.	Assumed 3,000 refugees to Thai camps.	Assumed 3,000 refugees to Thai camps, 1,000 illegals, 3,000 died in attempt to escape.
				Assumed 5,000 refugees to Vietnam.

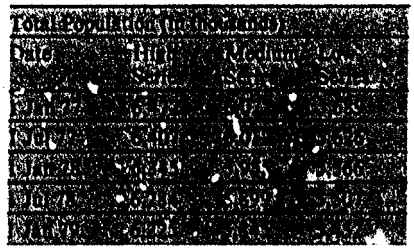
			population died.		
		Refugee flight continues.	Assumed 3,000 refugees to Thai camps.	Assumed 3,000 refugees to Thai camps, 2,000 illegals, 3,000 died in attempt to escape.	Assumed 5,000 refugees to Vietnam.
		More executions.	Assumed 10,000 executed.	Assumed 10,000 executed.	
1 Jul 76–1 Jan 77	Food again in short supply.	Famine again occurs in some areas; disease spreads among total population.	*Old people:* crude birth rate declines 6 percent. Crude death rate remains constant. *New people:* crude birth rate remain constant.		
			Crude death rate remains constant.	Assumed 4 percent of population died.	
		Refugee flight continues.	Assumed 3,000 refugees to Thai camps.	Assumed 3,000 refugees to Thai camps, 1,000 illegals, 3,000 died in attempt to escape.	Assumed 5,000 refugees to Vietnam.
		Final executions.	Assumed 5,000 executed.	Assumed 10,000 executed.	
1 Jan 77–1 Jan 79	Khmer Rouge still in control.	Food remains in short supply. Among the *new people*, the weak and vulnerable dead. Survivors learning to live under conditions, although still in dire straits.	*Old people:* crude birth and death rates remain constant for each half-year of the period. *New people:* crude birth rates remain constant for each half-year of the period.		
			Crude death rate remains constant for each half-year period.	About 2.5 percent of population died during each half-year period.	
		Refugee flight continues.	Assumed for each successive half-year period: 3,000, 2,000, 2,000, and 2,000 refugees to Thai camps.	Assumed for each successive half-year: 2,500 refugees, 2,500 died in attempt, and no illegals.	Assumed for each successive half-year of the period: 4,000, 4,000, 3,000, and 1,000 refugees to Vietnam.
					
1 Jan–1 Jul 79	On 7 January 1979 Phnom Penh fell to Vietnamese troops. Heng Samrin installed as head of new government.	Harsh labor requirements and repressive control measures of Pol Pot regime lifted, but new government unable to supply food, shelter, clothing, or health care.	Assumed crude birth rate for *old people* declined by 6 percent while rate for *new people* increases by 6 percent.		
		In Pol Pot-controlled areas, general deprivation and strict control still enforced. Physical security for civilian population poor as opposing forces fight for dominance.	Assumed about 2.0 percent of total population died during period.		
		Food for civilians, Vietnamese, and Pol Pot			

Table 4 Millions of Hectares

Area That Must Be Planted To Produce the Milled Rice Listed in Table 3 and Seed for Planting the Next Crop [1]

Population (millions)	Calories Per Person Per Day			
	1,200	1,500	1,800	2,100
4.5	0.851	1.064	1.277	1.489
4.6	0.870	1.087	1.305	1.522
4.7	0.889	1.111	1.333	1.556
4.8	0.908	1.135	1.362	1.589
4.9	0.927	1.158	1.390	1.622
5.0	0.946	1.182	1.418	1.655
5.1	0.965	1.206	1.447	1.688
5.2	0.983	1.229	1.475	1.721
5.3	1.002	1.253	1.504	1.754
5.4	1.021	1.277	1.532	1.787
5.5	1.040	1.300	1.560	1.820

[1] Based on an average yield of 1 ton of paddy rice per hectare, a milling conversion rate returning 0.7 ton of milled rice per ton of paddy rice, and a seeding rate of 0.07 ton of seed per hectare.

NOTE: Values for required planting areas based on other yield, milling, and seeding rates may be determined by summing the results of the following computations:

(a) Tons of milled rice desired divided by milling conversion rate divided by tons of paddy rice per hectare equals hectares required to produce rice for food.

(b) Hectares required to produce rice for food times seeding rate divided by tons of paddy rice per hectare equals hectares required to produce rice for seed.

- A yield of 1 ton of paddy rice per hectare.
- A milling conversion rate returning 0.7 ton of milled rice from each ton of paddy rice.
- An average seeding rate of 0.07 ton (70 kilograms) per hectare.[8]

The computations required to derive the planted area and seed requirements involve dividing the milled rice requirement (965,000 tons) by the milling conversion rate (0.7) to obtain the paddy rice equivalent (1,378,657 tons); dividing the paddy equivalent by the yield (1 ton of paddy per hectare) to obtain the area required to produce the paddy (1,378,657 hectares); and multiplying the area by the seeding rate (0.07) to obtain the amount of seed (96,506 tons) needed to meet the country's food requirements.

The additional area that must be planted with additional seed to assure production of seed for planting in 1981 is derived by dividing the amount of seed needed to produce food (96,506 tons) by the yield (1 ton of paddy per hectare) to obtain the area required to produce the paddy for seed use (96,506 hectares), and then multiplying that area by the seeding rate (0.07) to obtain the amount of seed (6,755 tons) needed to meet the country's seed requirements for 1981.

The total area that must be planted is computed by adding the area required to produce food (1,378,657 hectares) to the area required to produce seed (96,506 hectares) to obtain 1,475,163 hectares.

The total amount of seed required is computed by adding the amount of seed needed to produce food (96,506 tons) to the amount of seed needed to produce more seed (6,755 tons) to obtain 103,261 tons.

[8] Seeding rates have been reported to range from 40 to 45 kilograms per hectare for transplanted rice to 80 to 90 kilograms per hectare for directly seeded rice. FAO has used a seeding rate of 80 kilograms per hectare in estimating seed requirements for its Agricultural Rehabilitation Programme in Kampuchea—a rate implying that almost all planting will be done by the direct seeding method. Historical data, however, indicate that more than half of all rice was transplanted. While labor availability has been reduced by events in recent years, we do not feel that it has fallen so low as to virtually eliminate transplanting. A seeding rate of 70 kilograms per hectare allows for more direct seeding than in the past and for some transplanting as well.

Table 5

Tons

Rice Seed Required To Plant Various Areas at Differing Seeding Rates

Area (millions of hectares)	Tons of Seed Per Hectare					
	0.04	0.05	0.06	0.07	0.08	0.09
0.8	32,000	40,000	48,000	56,000	64,000	72,000
0.9	36,000	45,000	54,000	63,000	72,000	81,000
1.0	40,000	50,000	60,000	70,000	80,000	90,000
1.1	44,000	55,000	66,000	77,000	88,000	99,000
1.2	48,000	60,000	72,000	84,000	96,000	108,000
1.3	52,000	65,000	78,000	91,000	104,000	117,000
1.4	56,000	70,000	84,000	98,000	112,000	126,000
1.5	60,000	75,000	90,000	105,000	120,000	135,000
1.6	64,000	80,000	96,000	112,000	128,000	144,000
1.7	68,000	85,000	102,000	119,000	136,000	153,000
1.8	72,000	90,000	108,000	126,000	144,000	162,000
1.9	76,000	95,000	114,000	133,000	152,000	171,000
2.0	80,000	100,000	120,000	140,000	160,000	180,000

NOTE: Values for other areas and seeding rates not shown in the table may be determined by the following formula: area in hectares times (kilograms per hectare divided by 1,000).

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Bleak Prospects for Meeting Kampuchean Food Needs

A Research Paper

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Bleak Prospects for Meeting Kampuchean Food Needs

Summary

Food stocks in Kampuchea were expected to be virtually exhausted by the end of March. No significant amounts of food will be available from crops grown in Kampuchea until the next major rice harvest begins next December. The amount of food needed from April through November is estimated to total 645,000 tons of milled rice or its caloric equivalent.[1] The dry season rice crop now being cultivated will, at best, provide only 56,000 tons.

In addition to food, Kampuchean farmers will need an estimated 103,000 tons of rice seed if basic food self-sufficiency is to be attained in 1981.

Even with a successful dry season rice crop and the fulfillment of the reported assistance plans of international agencies, the USSR and Soviet bloc countries, and private agencies, Kampuchea will still have to secure almost 190,000 tons of food and more than 60,000 tons of rice seed.

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[1] Tonnages refer to metric tons throughout this report.

		people, the weak and vulnerable dead. Survivors learning to live under conditions, although still in dire straits.	*New people:* crude birth rates remain constant for each half-year of the period. Crude death rate remains constant for each half-year period.	About 2.5 percent of population died during each half-year period.	
		Refugee flight continues.	Assumed for each successive half-year period: 3,000, 2,000, 2,000, and 2,000 refugees to Thai camps.	Assumed for each successive half-year: 2,500 refugees, 2,500 died in attempt, and no illegals.	Assumed for each successive half-year of the period: 4,000, 4,000, 3,000, and 1,000 refugees to Vietnam.
1 Jan–1 Jul 79	On 7 January 1979 Phnom Penh fell to Vietnamese troops. Heng Samrin installed as head of new government.	Harsh labor requirements and repressive control measures of Pol Pot regime lifted, but new government unable to supply food, shelter, clothing, or health care.	Assumed crude birth rate for *old people* declined by 6 percent while rate for *new people* increases by 6 percent.		
		In Pol Pot-controlled areas, general deprivation and strict control still enforced. Physical security for civilian population poor as opposing forces fight for dominance.	Assumed about 2.0 percent of total population died during period.		
		Food for civilians, Vietnamese, and Pol Pot forces in short supply.			
		Refugee flight continues.	Assumed 17,000 refugees to Thai camps.		Assumed 17,000 refugees to Thai camps and an additional 40,000 in Thailand but not in camps.
1 Jul–1 Dec 79	Fighting resumed between Heng Samrin/Vietnamese and Pol Pot forces.		Assumed crude birth rate of 10 per 1,000 for total population.		
	Meager harvest.	Famine becomes widespread by end of October.	Assumed about 4.0 percent of total population died.		
	International relief effort started.	International relief effort not able to alleviate conditions.			
		Refugees from every part of country join flight.	Assumed 400,000 refugees to Thai camps.		Assumed 40,000 refugees from previous period returned to Kampuchea. Assumed 500,000 new refugees to Thai camps.

This table is Unclassified.

Appendix B

Alternative Estimates

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Bleak Prospects for Meeting Kampuchean Food Needs

A Research Paper

Research for this report was completed on 28 March 1980.

Comments and queries on this report are welcome and may be directed to:
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Bleak Prospects for Meeting Kampuchean Food Needs

There have been repeated expressions of concern in recent weeks that, in the absence of a continuing large-scale relief effort, famine conditions will reappear in Kampuchea. There is general agreement that output from the recently completed December-January harvest and relief supplies already in the country will be virtually exhausted by the end of March. This report presents estimates of the amount of food that will be needed until the next major harvest, and the amount of rice seed needed to make the planting of an adequate rainy season rice crop possible.

The reported assistance plans of international agencies, the USSR and Soviet bloc countries, and private agencies have not been accompanied by clear indications of either Kampuchea's total food and seed requirements or the assumptions made and methodology employed in estimating assistance needs. On the basis of assumptions and calculations detailed in appendix A, we estimate Kampuchea's total food requirement for the period 1 April through 30 November to be 645,000 tons of milled rice or its caloric equivalent. We also estimate that more than 100,000 tons of rice seed will be needed in 1980.

We believe recent press reports are correct in indicating that current food stocks in Kampuchea, including relief aid, will be virtually exhausted by the end of March. The next major harvest will take place in December, leaving a period of eight months during which large amounts of aid from abroad will be needed to sustain the country's estimated 5.2 million people. During this period, a total of 645,000 tons of milled rice or its caloric equivalent will have to be made available at an average daily rate of 2,644 tons in order to assure a basic 1,800-calorie-per-day ration for each Kampuchean.

The dry season rice crop, part of which has already been harvested and probably consumed, will provide no more than a brief respite from Kampuchea's food shortage problems.[2] The Heng Samrin government's official press agency claimed in early March that 80,600 hectares of dry season rice had been planted. In comparison, 78,000 hectares of rice was cultivated during the 1967-68 dry season and 105,000 hectares during the 1968-69 dry season, about 3 percent of the total rice area planted in those years. Even if 80,600 hectares had in fact been planted and the yield averaged 1 ton of paddy rice per hectare (a very optimistic figure), the harvest would provide only 56,000 tons of milled rice—an amount sufficient to provide rations for 21 days. The net effect would be to delay the date of food supply exhaustion from early April to late April and to reduce the amount of food aid needed prior to the major December harvest to 589,000 tons of milled rice or its caloric equivalent.

A second problem is to ensure that sufficient rice seed will be available for planting the crop that will be harvested in December. To return the country to a condition of basic self-sufficiency in edible and seed rice, 1.48 million hectares yielding 1 ton of paddy rice per hectare will have to be planted. A planting of this magnitude will require that 103,000 tons of seed be in the hands of farmers in time for the planting season starting in May. Imported seed probably could not begin arriving before early April, leaving about six weeks to get the seed to the farmers. If all seed has to be imported, this implies an average distribution rate of about 2,450 tons per day—distribution that would have to be accomplished in addition to the average daily food distribution of 2,644 tons. This would appear to be an unlikely achievement since Kampuchean authorities have had difficulty handling aid delivered at an average rate of 1,000 tons per day.

[2] Food crops can be grown throughout the year in Kampuchea, depending on availability of water, but the planting of the main rice crop is timed to begin shortly after the advent of the rainy season in May or June, with harvest in December-January. This is followed by a much smaller dry season rice crop.

Appendix C

Derivation of Population Estimate

Date	Event	Estimated Demographic Impact	Estimation Assumptions: High Series	Estimation Assumptions: Medium Series	Estimation Assumptions: Low Series
1 Jul 70–17 Apr 75	Civil war. Lon Nol government against Khmer Rouge and Vietnamese forces.	An estimated 600,000 to 700,000 war-related deaths.	Total population: UN estimate of 7,060,000 for 1 July 1970 used for all series.		
		Refugees flee to cities; urban population estimated at 4 million.	Births: UN estimated crude birth rate of 46 per 1,000 for 1 July 1970 accepted and decreased by 6.0 percent. Rate of decline nearly three times normal, but in line with type of decline estimated for war-ravaged areas of Bangladesh following the 1971 Bangladesh-Pakistan War.		
			Deaths: UN estimated crude death rate of 18 per 1,000 for 1 July 1970 held constant; added 600,000 war-related deaths (prorated evenly) in the High and Medium Series, and 700,000 in the Low Series.		
			Rates of growth: calculated, used estimated populations for beginning and end of period.		
17 Apr–1 Jul 75	Lon Nol defeated; Pol Pot and Khmer Rouge gain control of Kampuchea.	Estimated 250,000 to 500,000 flee to Vietnam.	Assumed 250,000 repatriated to Vietnam.		Assumed 500,000 repatriated to Vietnam.
	Population divided into urban and rural groups.	Urban population expelled from cities, forcibly moved to countryside.	*After subtraction of repatriates to Vietnam, assumed* new people *comprised the estimated 4 million in cities*, old people *the remainder—the 3.1 million assumed in rural areas.*		
			Old people: crude birth and death rates assumed constant at January–April 1975 level.		
		Numerous deaths during evacuation. No provisions, food and shelter inadequate. Population weak and listless; high incidence of pregnant women deaths.	*New people:* assumed 90 percent of expected births occurred (crude birth rate assumed same as *old people*'s).	Assumed 75 percent of expected births occurred.	Assumed 50 percent of expected births occurred.
			Assumed 7 percent of population died.	Assumed 10 percent of population died.	
	Lon Nol military personnel, civilian bureaucrats, and educated elite purged.	Destruction of leadership element of Kampuchean society and urban-based medical system.	*Assumed about 250,000* new people *targeted for execution not including families: 200,000 military; 30,000 civil servants; 20,000 of the educated, particularly teachers. Of 250,000: 20 percent died of hunger and disease, 50 percent of remaining executed in Medium and Low Series and 50 percent of that number executed in High Series.*		
		Executions begin.	Assumed 25,000 executed.	Assumed 50,000 executed.	
		Kampuchean refugees begin to flee to Vietnam.	*Assumed no refugees to Vietnam.*		*Assumed 30,000 fled to Vietnam during 1975-79 from* new people

Total Population (in thousands)			
Dates	High Series	Medium Series	Low Series
1 Jul 70	7,060	7,060	7,060
17 Apr 75	7,384	7,384	7,278

Total Population (in thousands)

Table 2

Tons

Milled Rice Required for the 1 April–30 November Period Under Varying Assumptions as to Population Size and Caloric Intake Per Person [1]

Population (millions)	Calories Per Person Per Day			
	1,200	1,500	1,800	2,100
4.5	372,203	465,254	558,305	651,356
4.6	380,475	475,593	570,712	665,831
4.7	388,746	485,932	583,119	680,305
4.8	397,017	496,271	595,525	694,780
4.9	405,288	506,610	607,932	709,254
5.0	413,559	516,949	620,339	723,729
5.1	421,831	527,288	632,746	738,203
5.2	430,102	537,627	645,153	752,678
5.3	438,373	547,966	657,559	767,153
5.4	446,644	558,305	669,966	781,627
5.5	454,915	568,644	682,373	796,102

[1] Based on 3.54 million calories per ton of milled rice.

NOTE: Values for populations and caloric levels not shown in the table may be determined by multiplying: 68.926554 times population in millions times calories.

Table 3

Tons

Milled Rice Required Per Year Under Varying Assumptions as to Population Size and Caloric Intake Per Person [1]

Population (millions)	Calories Per Person Per Day			
	1,200	1,500	1,800	2,100
4.5	556,780	695,975	835,169	974,364
4.6	569,153	711,441	853,729	996,017
4.7	581,525	726,907	872,288	1,017,670
4.8	593,898	742,373	890,847	1,039,322
4.9	606,271	757,839	909,407	1,060,975
5.0	618,644	773,305	927,966	1,082,627
5.1	631,017	788,771	946,525	1,104,280
5.2	643,390	804,237	965,085	1,125,932
5.3	655,763	819,703	983,644	1,147,585
5.4	668,136	835,169	1,002,203	1,169,237
5.5	680,508	850,636	1,020,763	1,190,890

[1] Based on 3.54 million calories per ton of milled rice.

NOTE: Values for populations and caloric levels not shown in the table may be determined by multiplying: 103.107345 times population in millions times calories.