Food Security Atlas of Cambodia

WFP
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World Food Programme

MSSRF

FOOD SECURITY ATLAS OF CAMBODIA

M. S. SWAMINATHAN RESEARCH FOUNDATION, India

and

WORLD FOOD PROGRAMME, Cambodia

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The following pertains to all maps in this Atlas:

WFP Disclaimer

The boundaries and names shown and the designations used on the maps in this book do not imply official endorsement or acceptance by the UN.

Message from His Excellency Tao Seng Huor

Poverty reduction, food security and nutrition improvement are interlinked, i.e. if poverty can be alleviated, food security and nutrition can be improved, and vice versa. Therefore, ensuring food security and nutrition for all Cambodian people is a growing concern for the Royal Government of Cambodia (RGC) whose intended goal is to gradually reduce the poverty in Cambodia so that the welfare and living standard of the people can be enhanced.

With a strong commitment to combating extreme hunger, indicated in the Cambodia Millennium Development Goals (CMDGs), and reducing poverty, the RGC has decided to establish a special working group called the **Technical Working Group on Food Security and Nutrition (TWGFSN),** which is co-chaired by the Council for Agricultural and Rural Development (CARD) and the Ministry of Planning (MoP) and co-facilitated by the United Nations World Food Programme (WFP) and the Food and Agriculture Organization (FAO). The TWGFSN, whose members are from relevant line ministries, donor agencies and NGOs, is responsible for the formulation of national policies and strategies with regard to food security and nutrition in Cambodia. The key functions of the TWGFSN are: i) to coordinate; ii) to share information among government ministries, donors and other organizations; iii) to monitor and provide feedback on progress towards national strategies and policies such as NPRS, CMDGs and the Rectangular Strategy; and iv) to formulate policies and strategies.

The TWGFSN will support medium-to-long-term policy formulation, sector planning and activity prioritisation aligned to wider policy dialogues. The TWGFSN will help identify, prioritise and fund innovative approaches and outstanding issues at the national policy level in this regard. It will also assist and facilitate decision making processes.

However, the TWGFSN will not duplicate the tasks of the various concerned line ministries. The TWGFSN will continue to play the main role in the planning, targeting, prioritisation and identification of indicators, as well as actual implementation and monitoring. To prove its effective functions, the TWGFSN has prepared a work plan, a results matrix and a strategy paper so that the issue of food security is fully considered and integrated in the NSDP. In its work plan, one of the priority tasks is to establish a Food Security Atlas, in order to map and focus on areas most at risk so that agriculture productivity can be improved. As one of the outstanding results, the Food Security Atlas of Cambodia, which will be the first publication of that sort in the country, has been developed by the United Nations World Food Programme (WFP) in collaboration with the M.S. Swaminathan Research Foundation (MSSRF) of India, with financial support from U.K's Department for International Development (DFID). We strongly believe that this Atlas, with detailed graphical information, will be used as a tool for development stakeholders to more accurately identify the most vulnerable areas for their timely and effective interventions.

Last but not least, on behalf of the Royal Government of Cambodia, I wish to extend my sincere and profound thanks to WFP and MSSRF of India for their great effort in the creation of this useful Atlas. Personally, I would like to thank Mr. Thomas J. Keusters, WFP Country Director and Representative, and H.E Nouv Kanun, CARD Secretary General, as well as the staff from WFP and CARD, for assisting in the production of this Food Security Atlas of Cambodia.

Tao Seng Huor,

Senior Minister, Vice-Chairman of CARD

Foreword

Food and drinking water constitute the first among the hierarchical needs of a human being. Hence, every child, woman and man should have the right to food and drinking water. The M. S. Swaminathan Research Foundation has defined food security as the "physical economic, social and environmental access to a balanced diet and clean drinking water." Non-food factors like access to sanitation, primary healthcare and education are also important for providing every citizen with an opportunity for a healthy and productive life.

A team of experts headed by Dr Swarna S. Vepa of MSSRF and the World Food Programme, New Delhi have been engaged in analyzing factors related to sustainable food security in India during the period 2000 to 2004. Food security has been analyzed using multiple indicators from the points of view of **Availability**, a function of production, **Access**, a function of purchasing power and sustainable livelihoods, and **Absorption**, a function of clean drinking water, environmental hygiene and primary health care. Food insecurity has been studied in the following three dimensions. **Endemic**-characterized by poverty induced undernourishment , **Hidden**-caused by the deficiency of micronutrients like iron, iodine, zinc and vitamin A, **Transient**-resulting from drought, floods and other natural disasters.

The joint MSSRF-WFP studies have provided the basic data and insights essential for preparing an Action Plan for a hunger-free India. We are grateful to the Royal Government of Cambodia and the World Food Programme, Cambodia for inviting us to participate in the preparation of a Food Security Atlas of Cambodia. Our team led by Dr Swarna S Vepa and comprising Ms Deepa Varma, Ms Anuradha and Ms Gnanappazham were greatly inspired by the commitment of RGC, as well as the Working Group on Food Security and Nutrition, to achieve a total eradication of hunger and poverty, as soon as possible. Similarly, our team was stimulated by the commitment of WFP Cambodia to assisting RGC in achieving the goal of a malnutrition–free Cambodia by 2015, the target year for reducing hunger and poverty by half under the UN Millennium Development Goals. To me, it has been a particular privilege to have been associated with this exciting endeavour. My association with Cambodia in improving the productivity of rice farming systems started in 1985, when I was the Director General of the International Rice Research Institute, the Philippines. With the visionary support and guidance of H. E. Prime Minister Samdech Hun Sen, I was able to develop a rice research and development programme, including a large capacity building programme with financial support from the Government of Australia. I am happy that the RGC - IRRI programme has resulted in substantial progress in improving rice production and consumption in Cambodia.

I hope this unique Atlas will help TWGFSN and CARD to prepare and implement Mission 2015: a hunger and poverty free Cambodia. In predominantly rural and agricultural countries like Cambodia and India, enhancing the productivity and marketable surplus of small farmers is the single most important step in the eradication of poverty and chronic hunger. On behalf of my colleagues in MSSRF and myself, I pledge our total scientific support in helping to convert RGC's and WFP's vision of a hunger-free Cambodia into a reality.

M S Swaminathan

Chairman, MSSRF

Chairman, National Commission of Farmers, Govt. of India, New Delhi

Preface

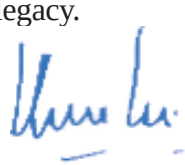
It is my pleasure to introduce the Food Security Atlas of Cambodia, which WFP has produced in collaboration with the M.S. Swaminathan Research Foundation (MSSRF) of India. The Foundation has been dealing with the issue of food security for many years. Their work has earned them a reputation of excellence in this field. The chairman of MSSRF, Prof. M. S. Swaminathan's dedicated work in this area earned him many laurels and has led UN Secretary General, Kofi Annan, to entrust Prof. M.S. Swaminathan, with the co-chairmanship of the UN Millennium Project's Hunger Task Force. We are honoured to have the Foundation as our partner in this unique venture for Cambodia and pleased to support this example of South /South collaboration. We hope that readers will appreciate the contribution in research and analysis that this Atlas brings.

Food Security is influenced by poverty, health, education and agriculture, among other socio-economic factors. By "mapping" the intensity and locations of poverty, child malnutrition, literacy, etc., we have attempted to determine where the Cambodian people are the most vulnerable and food-insecure. The time and space available for this edition allows us to present maps mostly at the provincial level. However, an understanding of the prevailing situation at the grass roots level will also be useful in targeting development efforts. Therefore, in the months to come, WFP will make available on the Cambodian Caminfo website digital maps that cover the district and commune levels. Furthermore, as new data from various socio-economic and sectoral surveys become available, we intend to update the maps to allow development stakeholders to have the most recent and detailed graphical information at their disposal. Thus, over time, they will be able to better target and improve the effectiveness of their interventions. Clearly, the impact of interventions will be greater if development initiatives are targeted towards the geographical areas of the country that are trailing behind. Infant mortality, literacy and the other human development indicators will improve more significantly if access to health services and school attendance is improved in the provinces taking priority.

Food Security is a cross-cutting issue. Food aid alone will not allow Cambodia to reach the Millennium Development Goal of eradicating extreme poverty and hunger, which is WFP's primary concern. However, WFP firmly believes that food aid can complement and improve the effectiveness of non-food aid interventions: a newly built school, for example, will be more useful if WFP helps, through food assistance programmes, to ensure that all children attend it. If pupils are hungry, they will not learn properly. If girls drop out because they have to look for food or work in the fields, the poorest and most vulnerable will continue to be excluded from basic education. Thus, the ultimate objective of building the school will not be met. WFP will therefore continue to seek partnerships, target its assistance to the most food insecure areas, and promote a greater integration of its assistance with that of its development parters. This is where food aid can become the catalyst for change.

Many people reviewed the various drafts of this Atlas and we are grateful for their contributions. A special word of thanks must go to the U.K.'s Department for International Development (DFID) for their financial support, which allowed the study to be undertaken and this first edition to be published.

In closing, I would like to dedicate the Food Security Atlas of Cambodia to the memory of Martha Teas, a former employee of WFP in Cambodia, who was one of the victims of the attack on the UN compound in Baghdad of 19 August 2003. She was a pioneer in the Vulnerability Assessment and Mapping (VAM) efforts in the country. May this work be a testimonial to her legacy.



Thomas J. Keusters
WFP Representative, Cambodia

FIRST STEERING COMMITTEE MEETING

(Food Security Atlas of Cambodia)

Date: 12 May 2005, at 11:00 am
Venue: Meeting Room, WFP Country Office

Participants:

1. H.E. Nouv Kanun, Secretary General, CARD
2. Mr. Thomas J Keusters, Country Director, WFP
3. Mr. Kimoto Tsukasa, Resident Representative, FAO
4. Mr. Ramaraj Saravanamuttu, Deputy Country Director, WFP
5. Ms. Mari Honjo, Programme Officer, WFP
6. Ms. Tep Saravy, VAM Officer, WFP
7. Mr. Ngin Chhay, Deputy Director, MAFF
8. Ms. Swarna S Vepa, Programme Director, and Consultant to WFP
9. Mr. Sao Sopheap, Programme Officer, FAO
10. Ms. Jutta Diekhans, Nutrition Programme Officer, HKI
11. Ms. Tania Goossens-Allen, Food Security Adviser, GTZ
12. Mr. Peter Kaufmann, Food Security Team Leader, GTZ
13. Mr. Kent Helmers, Consultant, TWGFSN, GTZ
14. Ms. Chhin Lan, Assistant Project Officer-Nutrition, UNICEF
15. Mr. Kong Chanthy, Administration Officer, CARD
16. Mr. Touch Dara, MoH
17. Mr. Ou Kevanna, Manager of NNP, MoH

SECOND STEERING COMMITTEE MEETING

(Food Security Atlas of Cambodia)

Date: 7 September 2005, at 3.00 pm

Venue: Meeting Room, Council for Agricultural and Rural Development, Council of Ministers, Royal Government of Cambodia

Participants:

1. H.E. Mr. Nouv Kanun, Secretary General, CARD
2. H.E. Mr. Chay Borin, Deputy Secretary General, CARD
3. H.E. Plong Sareth, Deputy Secretary General, CARD
4. H.E. Mr. Rath Virak, Deputy Secretary General, CARD
5. H.E. Nhek Samoeun, Under Secretary of State, MoP
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20. Ms. Khieu Borey, Deputy Director General, MoP
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We would like to thank the UN World Food Programme of Cambodia, who gave us the opportunity to work on this interesting project. We also thank Prof. M. S. Swaminathan, Chairman, MSSRF, for his constant guidance and Dr. M. Velayutham, Executive Director, MSSRF, for his valuable suggestions throughout the report. We are thankful to Ms. Sandhya Sundar, Ms. Hema Sukumaran and Mr. Sashi Nair for editorial assistance.

In May 2005, our team had discussions with the following persons and gained insights into the food security situation of Cambodia. We are extremely grateful to these persons and institutions for the valuable insights given to us. We are also grateful for the documents and materials given to us, without which this report would not have been possible.

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35. Mr. Younus Khan, WFP
36. Ms. Mari Honjo, WFP

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PROVINCE NAMES AND ABBREVIATIONS USED IN THE MAPS

No.	Province Name	Abbv.	Zones
1	Banteay Meanchey	BY	Tonle Sap
2	Battambang	BD	Tonle Sap
3	Kampong Cham	KC	Plain
4	Kampong Chhnang	KN	Tonle Sap
5	Kampong Speu	KS	Plateau/Mountain
6	Kampong Thom	KM	Tonle Sap
7	Kampot	KP	Coastal
8	Kandal	KD	Plain
9	Koh Kong	KK	Coastal
10	Kratie	KR	Plateau/Mountain
11	Mondul Kiri	MK	Plateau/Mountain
12	Phnom Penh	PP	Capital
13	Preah Vihear	VR	Plateau/Mountain
14	Prey Veng	PV	Plain
15	Pursat	PO	Tonle Sap
16	Ratanak Kiri	RK	Plateau/Mountain
17	Siemreap	SR	Tonle Sap
18	Sihanoukville	SI	Coastal
19	Stung Treng	ST	Plateau/Mountain
20	Svay Rieng	SG	Plain
21	Takeo	TA	Plain
22	Oddar Meanchey	OT	Plateau/Mountain
23	Kep	KB	Coastal
24	Pailin	PI	Plateau/Mountain

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ACRONYMS

ADB	Asian Development Bank
ASEAN	Association of South-East Asian Nations
AusAID	Australian Agency for International Development
BCM	Billion Cubic Metres
BMI	Body Mass Index
CARD	Council for Agricultural and Rural Development
CCC	Cooperation Committee for Cambodia
CDC	Council for Development of Cambodia
CDHS	Cambodia Demographic and Health Survey
CDRI	Cambodia Development Resource Institute
CIDA	Canadian International Development Agency
CIPS	Cambodia Inter-censal Population Survey
CNIP	Cambodia Nutrition Investment Plan
COCMA	Central Company of Agricultural Materials
CRRI	Cambodia Rice Research Institute
CSES	Cambodia Socio-Economic Survey
DANIDA	Danish International Development Agency
DFID	Department for International Development, United Kingdom
EC	European Commission
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign Direct Investment
FSNPS	Food Security and Nutrition Policy Support Project
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HDI	Human Development Index
HKI	Helen Keller International
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome

HYV	High Yielding Varieties
ILO	International Labour Organisation
IMF	International Monetary Fund
IMR	Infant Mortality Rate
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency
LFS	Labour Force Survey
MAFF	Ministry of Agriculture, Forestry and Fisheries
MEDiCAM	Membership Organisation for Cambodian Health NGOs
MMR	Maternal Mortality Rate
MIME	Ministry of Industry, Mines and Energy
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MoEYS	Ministry of Education, Youth and Sport
MoH	Ministry of Health
MoP	Ministry of Planning
MoWA	Ministry of Women's Affairs
MoWRAM	Ministry of Water Resources and Meteorology
MRC	Mekong River Commission
MRCS	Mekong River Commission Secretariat
NGOs	Non-Governmental Organisations
NPRS	National Poverty Reduction Strategy
NSDP	National Strategic Development Plan
PADEK	Partnership for Development in Kampuchea
PDWA	Provincial Department of Women Affairs
PFD	Partners for Development
RGC	Royal Government of Cambodia
SEDPII	Second Socio-Economic Development Plan
SRI	System of Rice Intensification
TGA	Total Geographical Area

UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNIFEM	United Nations Development Fund for Women
UXO	Unexploded Ordnance
VAM	Vulnerability Analysis and Mapping
WB	World Bank
WFP	World Food Programme
WHO	World Health Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

FOOD SECURITY ATLAS OF CAMBODIA

I. Food Availability and Production

Analysis of the food production situation in Cambodia from 1993 to 2003 shows an increase in rice production. The country is self-sufficient in rice production today despite not reaching its full potential. The growth in area under cultivation, as well as yield growth, have together contributed to production growth. However, it may not be possible to sustain this growth in production in future unless specific steps are taken to improve productivity. A key factor that explains the rapid increase in the rice production, post-1994, is the end of conflict in Cambodia. This has allowed the strife-torn country to return to normalcy.

There is not only considerable scope for increasing food production through productivity growth, but also scope to reduce instability in production and incomes through flood control, protective irrigation, crop and enterprise diversification, which would benefit low-income small farmers. Moreover, there are ample opportunities for export. As agricultural technology is largely scale-neutral for rice cultivation, the main focus of intervention should be productivity enhancement on small farms. However, necessary investments in infrastructure, markets and mechanisms for technology transfer are needed.

Instability in Yield

One of the major concerns is instability in yield. Production instability is higher in Cambodia than in the rest of Asia, mainly due to the lack of assured protective irrigation. Unstable production leads to unstable incomes, which in turn forces small farmers into a debt trap and increased poverty. Hence, protection against instability is critical. Instability in crop yields can be attributed to frequent natural calamities, like drought and flood.

The diversification index for crops is not very high in Cambodia. Also, the nation is highly prone to disasters. While mountainous regions are susceptible to flash floods, the plains are prone to flooding from excess water in the Tonle Sap and Mekong Rivers. Water shortages are common, which can be attributed to inadequate irrigation, as well as the poor moisture retaining capacity of soils in some areas.

Rice Productivity

About 35-40% of the total area on which rice is traditionally cultivated has sandy soil, sandy soil over clay, or loam soils. Overall, these soil types have moderate to low fertility and little moisture-holding capacity. Hence, nutrients and organic material are leached or swept out due to water erosion. The soil is vulnerable to drought in periods of low rainfall, but is favourable for rice cultivation when flooded. Water availability seems to be the main requirement for a favourable continuation of rice cultivation in these areas. Also, these soils are not suited to the cultivation of other crops. Hence, there are few alternatives to continued rice cultivation, especially for the small farmers, who produce rice for self-consumption.

The Cambodian uplands are suited for rice and respond well to fertilizer and irrigation. The uplands contain high organic matter and have good water-holding capacity. The main constraints are the dependency on rain and inadequate irrigation. For these reasons, very little rice is grown in these areas. Diversification into other crops, including horticultural crops, could help these regions.

About 60% of the rice-growing area, including deep-water rice, lies in regions having fertile soils of loam and clay, with high water-retention capacity. These soils are present to varying degrees in all provinces. The major problem encountered is water logging. Thus, water management is the key for improving the productivity of rice in these areas.

Analysis using geographical information systems and overlaying maps of soil and rice growing areas helped in identifying four provinces as target areas where interventions related to yield improvement would result in substantial gains: Kampong Speu, Prey Veng, Siemreap and Svay Rieng. These provinces have soils favourable for rice cultivation although yields remain low. An intensive area development programme offering integrated support through transfer of technical knowledge, timely delivery of quality inputs and development of market linkages is required to improve crop productivity.

Land and Forest Resources

The access to land in Cambodia is limited by commercial concessions, poor infrastructure and the presence of landmines. Thus, despite a high land to population ratio, the per capita availability of agricultural land is low. There is also a low average size of land holdings, which was 0.96 hectares in 2000. High inequality in land distribution (Gini-coefficient 0.57) is the result of demographic pressure, population movements, weak institutional credit markets that fail to protect farmers from losing land to moneylenders, and speculative land purchases by the better off.

Cambodia had more forest cover prior to 1994 than at present. Heavy logging during the early 1990s has damaged significant areas of dense forest. The extent of dense forest with a canopy cover of 40% is not known and there is general lack of information on the productivity and use of forests. The mangrove forests that form the swamp wetlands of Cambodia have also been damaged over time due to reduced river flow and the expansion of rice cultivation.

Water Resources

Cambodia has abundant water resources from rainfall, the Great Lake and rivers, including the Mekong. However, the country is subject to high levels of variation in water availability, ranging from flooding that damages crops and property to water scarcity, to parched fields and widespread drought. Rainfall variations are high (1,400 mm - 4,000 mm) across geographical regions. Typically, monsoon rains take the form of seasonal downpours followed by a prolonged dry season. The variations in the water flows of the Mekong River and Tonle Sap Lake are the result of the release of water from upstream dams, and is influenced by either flood or drought. Prudent water management has proved extremely important to the country in the past. Given the very fragile topography and its susceptibility to water erosion, the provision of vegetative cover to stop water erosion is also crucial in Cambodia.

Cambodia's irrigation potential, both from surface water and ground water, has not been properly assessed. The Cambodian situation is unique in that it needs deep water, lowland, as well as highland varieties of crops, to suit the moisture variations. All regions are subject to wide variations in moisture availability for crop growth in all seasons. Hence, protective irrigation should be a priority to reduce the yield risk. Adopting various methods for conserving rain water, flood and river water for irrigation is vital. Small to medium-sized lift irrigation projects should be identified and executed. Ground water exploitation faces some risks of arsenic contamination. More research in this area is also necessary. Despite its abundant water resources, the lack of protective irrigation is the single most important constraint to Cambodian agriculture.

Cambodia's water resources are also severely affected by excessive silt formation due to deforestation and flooding. This has not only affected cultivation but possibly fisheries as well. There has been a reduction in the catch of large fish species, and the sustainability of fishing has also been threatened.

Fish and meat production have recorded improvements. Fishery production, as a whole, appears good but there are reasons to be concerned about its sustainability. The catch of large and medium-sized fish appears to have declined in freshwater fishing areas for several reasons, including declining water resources, encroachment of crops onto flood plains and overfishing.

Diversification of livelihoods in the plains, backed by market support, can improve this situation. For instance, enterprise diversification to livestock or profitable aquaculture can be considered. Floodwaters can be adequately trapped for aquaculture, along with deep-water rice.

II. Food and Livelihood Access

Cambodia's GDP growth has registered impressive growth since 2000, reaching 7% in 2004. However, the share of agriculture in GDP is only 30%, despite the large percentage of people (74%) who depend on the sector. This means that the productivity per worker in agriculture is very low. On the whole, development prospects are encouraging as reflected in high rates of GDP growth, increasing literacy rates, and the low density of population compared to the availability of natural resources. However, the key to development in Cambodia is an increase in productivity per worker and the sustained utilisation of natural resources. The demand from Cambodia's neighbours for cheap skilled labour and primary products indicate that export markets are available but that these markets need to be effectively exploited in a competitive manner.

Cambodia's immediate aim should be to enhance productivity in agriculture that will help effectively reduce hunger and poverty, and enhance competitiveness in rice production for export.

Poverty Level

According to estimates, there are wide variations in poverty levels within and between provinces. A recent household survey provides indications that poverty has declined in the country, as a whole, but it remains a serious problem in rural Cambodia, with a concentration in the less-educated sections of the population. The analysis in this study shows that literacy by itself does not seem to make a significant difference to poverty levels, but education beyond primary and secondary level does have an impact.

The Participatory Poverty Assessment indicates that poverty was high among families with a large number of children (compared to adults in the family), in female-headed households, and in households with low levels of education. Natural disasters, lack of health care, gambling, alcoholism, lack of land and access to natural resources were other factors for the high incidence of poverty.

This study has examined the relationships of poverty indicators at the household level with the help of the Cambodia Socio-Economic Survey 2004. The household-level analysis of 9,000 households reveals that seasonal variations do exist in food consumption, leading to transient food shortages and pockets of hunger in the country. The level of food intake was found to be heavily influenced by the category of occupation. Those employed as labourers had a much lower level of consumption than surplus farmers. Subsistence farmers also consume less. Literacy was related positively with the level of food intake, even in the rural areas of the country.

Population, Labour Force, Education and Employment

The population growth rate in Cambodia is high and the age composition is tilted towards the younger age groups. There are more females in the Cambodian population than males (93.5 men for 100 females) due to distortions brought about by past conflict. However, the sex ratio in the 0-14-year population group is skewed in favour of boys.

The labour force participation is high in Cambodia compared to the rest of Southeast Asia due to the high involvement of unpaid family workers of the younger and older age groups in family enterprises. However, women seem to enter and leave the labour force early, while men enter the labour force late and work till the age of 65 and above. The labour force participation in rural areas is especially high because of the involvement of children.

Overall, the literacy rate is lower for women than men in Cambodia. In many cases, the employment of children in family enterprises affects school enrolment. In rural areas in particular, the education levels of girls is much lower than that of boys. What is also noticeable is that the gender gap increases at higher levels of education, as a large percentage of girls are forced to drop out from school and work at a very young age. In addition to the disparity in education, an employment gap exists between the sexes in the highly educated group.

The majority of Cambodians are employed in the primary sector, followed by the tertiary sector. Most of them comprise own-account workers and unpaid family workers. The situation points to possible large-scale under employment in the economy. Only 12.9% of the population has regular paid employment while only about 9% of women fall under this category. With the garment industry playing a major role in enhancing employment opportunities for women, wage employment opportunties are seen to be increasing among women compared to men. Employment for women is high in the age group of 24-34 years. There is an increasing migration of women, especially in the younger age groups, in search of better employment opportunities. The overall unemployment rates are low in Cambodia, but the percentage of unemployed women is slightly higher than that for men.

Female-Headed Households and Feminisation of Agriculture

Women head close to a quarter of the households in Cambodia. This is the result of past civil strife that left many women widowed and orphaned. This is now seen to be increasing due to the migration of men in search of better job opportunities. This has also led to a slow, but steady feminisation of agriculture. Prey Veng, with 31%, and Pailin, with 32.5%, have the largest percentage of the female-headed households. These provinces are also the poorest, with a poverty ratio of 53% in Prey Veng and 97% in Pailin. This is mainly because of the high incidence of landlessness and the neglect women face when it comes to factors, such as credit facilities, technology, agricultural research and extension. The female-headed households require further assistance when it comes to issues of food security and access to livelihoods.

Landlessness

Many families in Cambodia's rural areas encounter problems of landlessness and inequitable land distribution. The landless agricultural labourer earns very little and suffers more during drought and floods. The causes of landlessness are low incomes and low productivity, which leads to indebtedness and loss of land. There are also historical reasons, such as migration caused by conflict, and the loss of land records for those who returned after many years of conflict, especially during the Khmer Rouge regime. In the provinces with a high percentage of the landlessness, such as Kratie (39%), Koh Kong (38%), Battambang (29%) and Pursat (26%), a greater proportion

of the population derive their livelihoods from contract farming, fisheries and commercial plantations. While Koh Kong has low poverty at about 8%, the other three provinces have a high level of poverty, ranging from 40% in Pursat, 39% in Kratie to 26% in Battambang. The reallocation of land in Cambodia in 1992 was discriminatory, especially towards smaller households, such as female-headed households. The possession of land without ownership rights is a constraint to credit. In 2001, a new Land Law took effect and a Cadastral Commission was formed to settle land disputes. A large number of land titles were issued in various provinces to facilitate access to credit.

The benefits of land concessions have not been fully realised. A large part of the produce went illicitly to neighbouring countries without the revenue reaching the government treasury. On the other hand, forest concessions have depleted forest wealth by reducing densely forested areas, with only limited efforts to regenerate forests. In 2001, some commercial concessions on agricultural land, forests and fisheries were cancelled. Local people were given access to land through social concessions and contract farming was encouraged, with the idea of generating revenue for the State.

The average size of plots of cultivated land in Cambodia is very small, and naturally, it brings to the fore the question of the viability of farming and its capacity to provide livelihoods to people. The breakdown of expenses incurred in crop production in the wet and the dry seasons shows that chemical fertilizers and planting material comprise a substantial percentage of the production cost in both seasons. There is not much difference between wet season and dry season crop profitability. On average, farming is a profitable business in Cambodia.

In Cambodia, the poorest are dependent on agriculture, with a limited resource base and no social security. The landless, illiterate, and those with unviable farm enterprises, must be assisted to diversify into enterprises such as aquaculture, poultry, livestock, and vegetable production, so that more food is produced, eaten at home and traded. Markets across the Cambodian borders must also be targeted.

Future Prospects

The dividends from secondary education appear to be positive for the Cambodian population. Given the small size of the labour force, increasing labour costs in neighbouring countries and the rising literacy rates of younger people, the future prospects are promising. However, for this to materialise, Cambodia must take advantage of its availability of skilled labour and competitive wage rates, either to attract Foreign Direct Investment (FDI) or to send workers to be employed in other countries. Migration of skilled workers is a positive opportunity for the Cambodian people, since it would push up wages at home and encourage people to invest in education and vocational training. Relatively speaking, Cambodia is well-placed to take advantage of these opportunities since its population is small and the total investment needed for human resource development is proportionately less. However, the challenge is daunting and a huge effort is required to mobilise the necessary resources and the political commitment for development.

III. Food Absorption and Nutritional Security

The average life expectancy remains low, with the life expectancy of females higher than males. The level of morbidity remains high as the general populace is greatly affected by diseases, such as diarrhoea, acute respiratory infection, malaria, dengue, hemorrhagic fever and other vaccine-preventable diseases. High amputation rates are also prevalent due to land mines and unexploded ordnance (UXOs), though an increasing part of the affected areas has been demined.

Mother and Child Care

Women in Cambodia are vulnerable to reproductive health problems and malnourishment. Poverty and the cost of health care, along with lack of education and awareness, are the main factors responsible for the poor access to health services among women. The maternal mortality rate is generally high, due to malnourishment during pregnancy and poor antenatal care. The other reasons are abortion complications, eclampsia and haemorrhage. This is mainly because most births take place outside healthcare facilities. Post-natal mortality is also very high.

Breastfeeding though almost universal, is delayed in Cambodia. A very small percentage of newborns are breast fed within an hour of birth. Most receive supplementary foods and fluids too early. However, the introduction of supplementary food to infants six months and above is not rapid and widespread. Malnutrition in infants who are breast-fed is low. Very few children, according to the Cambodia Demographic Health Survey (CDHS), had received the mandatory vaccines, and the dropout rates for polio and DPT vaccines were very high.

Cambodia is a nation severely affected by Iodine Deficiency Disorder. The prevalence rate of iron deficiency among pregnant women and children is also very high. Three-quarters of Cambodian provinces recorded incidents of Vitamin A deficiency. This in turn leads to diseases such as measles, acute respiratory infection and diarrhoea. Cambodian women suffer from chronic energy deficiency and low body mass index.

Child Malnourishment

The CDHS survey indicates that chronic malnutrition among Cambodian children is high, with most being moderately stunted. The level of stunting increases with age and there was very little difference in the extent of stunting among the sexes. The length of birth interval, the spacing between children in number of years, was inversely related to stunting. A high proportion of wasted children can be attributed to inadequate food supplementation during weaning and exposure to diseases. According to the CDHS survey, the socio-economic background and the mother's educational background were important factors in the determination of the health status of the children.

An analysis of CDHS data on Cambodian households reveals that the greater the number of children in the household, the greater the likelihood that the child will be underweight. Children who were breastfed were not underweight and the first-born was better off than the other children. Immunisation had no significant influence on the weight, relative to the age of the infant. The morbidity index showed a negative influence – children with a high incidence of disease were underweight for age. Better sanitation meant healthier children. The mother's education beyond primary level was related to a lower incidence of underweight children, whereas education of the father had no relevance to the child's weight.

Other poverty indicators, such as electricity or a television set at home, were related to fewer underweight children. Another interesting result of the analysis is that when the mother was employed as a labourer or in services, there was not much difference in the child's weight-for-age. However, if the mother was employed in agriculture, her child was more likely to be underweight. Education of the mother beyond secondary level also made a difference to the underweight status of the child.

Health Care and Sanitation

There is an under-utilisation of the healthcare system, probably due to the high cost of medicines and medical care. Hence there has been an insufficient use of health facilities in some parts of the country. Many people prefer treatment at home, or to consult pharmacists, because hospital facilities are inadequate.

The access for the poor to basic facilities, such as sanitation and safe drinking water, is limited. Even in towns, medical waste is carelessly dumped on roads, and methods of general garbage disposal are inadequate. Food sanitation tests are sporadic and inadequate, with no established system for food management and testing.

IV. Food Security Index

The Food Security Index of Cambodia, a combination of 10 indicators, indicates the most food insecure provinces in Cambodia. The provinces highlighted as severely food insecure in the food security index map are worse off than the other provinces in many respects. On the whole, the plateau and mountain regions of Mondul Kiri, Oddar Meanchey and Ratanak Kiri are the most food-insecure provinces. They are worse off in terms of almost all the indicators because habitations are in remote areas that cannot be reached easily and, hence, remain neglected. Other severely food insecure provinces include those of Siemreap, Kratie, Kampong Thom and Kep. Commune-level maps provide help in the identification of the most vulnerable areas within these provinces.

These provinces require safety nets, mobile healthcare facilities and improved infrastructure and communications in the short term. The government's focus must be on providing services to these areas at a low cost. Education and support to local enterprises must be the next priority.

CHAPTER - 1

Introduction

CHAPTER

I

Introduction

1.1 Introduction

"The Food Security Atlas of Cambodia" aims to assess the extent of hunger and poverty in Cambodia. It also examines the causes of poverty and hunger. The possession of the means of livelihoods, such as land, water, credit, technology, education and skills, are key to eradicating poverty. Furthermore, poor people face hardships if there are no public services and safety nets. These issues are considered in this study under the title of food security. This is not a research document in the strict sense, but largely a compilation of existing information for ready reference. In many ways, the study is a means of dissemination, meant for those who wish to know more about the current food security situation in the country and the areas that need intervention. It also supports the planning of effective action. The Atlas contains a number of maps, thematic, as well as satellite images, which help to visually illustrate conditions at the sub-national level. If the Atlas provokes thought and action by those concerned with food security, its purpose would be served.

1.1.1 Objective of the Study

The first and main objective was to present the food security situation in Cambodia in its three dimensions of food availability, food access and food absorption, with the help of some key indicators. The second objective was to develop a Food Security Index that ranked the provinces and municipalities, as well as the communes in Cambodia in terms of the seriousness of the problem of food security. The third objective was to highlight the major issues of concern regarding food security and to suggest some long-term solutions by way of policies and programmes that would make Cambodia more food secure.

1.1.2 Definition of Food Security

The term 'Food Security' may mean different things to different people. It has been widely used in different contexts. The United Nations Food and Agricultural Organization (FAO) released a report titled 'Food for All' during the World Food Summit in 1996, in which 'Food Security' was comprehensively defined. For the purpose of this study, 'Food Security' has been defined as the physical, economic and ecological access to sufficient, safe and nutritious food to meet dietary needs and food preferences for an active, healthy and productive life.

The first dimension of food security is the availability of food at the national, as well as sub-national levels, ensuring that sufficient quantity is available at a place and time when needed. The availability of food at the sub-national level becomes important if the region is difficult to reach for various reasons, perhaps due to natural disasters, lack of infrastructure or the existence of conflict. Availability can be ensured either through domestic and local production or import and distribution across regions. The second dimension of food security is food access, which is determined by the purchasing power of a person. It is directly related to livelihoods and income. In other words, the levels of poverty and unemployment have a direct bearing on the economic access to a balanced diet. An unequal access to

livelihood opportunities may exist due to differential access to education, discrimination related to gender, community, and place of residence. The third dimension of food security is food absorption, which implies that a person must be able to assimilate the food consumed, in order to live a healthy and long life. Nutritional security is a part of food absorption.

Unless decent health infrastructure, sanitation and safe drinking water facilities exist, people will not be able to lead a healthy and long life even if they have enough to eat. A balanced diet that provides all the essential nutrients, as well as micronutrients and vitamins, has to be ensured for a healthy life.

Ecological access to food has been added to the definition of food security to bring out the aspect of environmental sustainability. In 1987, a report entitled 'Our Common Future', published by the World Commission on Environment and Development, chaired by Dr. Gro Brundtland, introduced and defined the word 'sustainability'. According to the report, sustainability is about meeting present needs without compromising future needs.

The state of natural resources is especially important for sustaining food production. Forest and vegetative cover, and natural ecosystems, such as wetlands, are important for the quantity and quality of water, fauna and flora. Water, flora and fauna are vital to sustain crop and livestock production, fisheries and forestry. They are equally important for the sustainability of rural livelihoods. Clean and sufficient water and a healthy atmosphere free from pollution and health hazards are necessary to live a healthy life.

In the past, preserving ecological wealth and pursuing economic development were considered contradictory to each other. It was thought that one had to sacrifice economic development to achieve ecological health and vice-versa. The subject of reconciling the environment and economic development was first discussed in 1972 in Stockholm at the United Nations Conference on Human Environment. At the time, many countries feared that environmental protection might forestall rapid economic development.

As economic development spread and ecological degradation continued unabated, a realisation dawned that ecological degradation would indeed sooner or later act as a limiting factor on economic development. Planners have also come to realise that protecting the ecological base is vital for food production and livelihood access, and that a balance between ecological health and economic development has to be struck. However, the conservation of natural resources for the sake of conservation has no meaning when people are poor and hungry. Similarly, high levels of agricultural production and employment are meaningless if they are short-lived. For example, the destruction of forest and vegetative cover or encroachment upon wetlands may add value to agricultural production and generate jobs in the short-run, but the benefits do not accrue in the long-term. The lack of forests to regulate rain water and overflow from rivers result in excessive run-off water and flash floods. Run-off water leads to the removal of topsoil, frequent flooding, soil alkalinity and reduced water levels in water bodies, as well as ground water. Crop production, fisheries and forestry do not survive for long in such conditions. Food security goals must, therefore, be pursued and achieved through the sustainable use of environmental resources.

The ecological dimension broadens the World Food Summit definition of food security. All three basic dimensions of food security – food production, food access and food absorption – in turn, depend upon the health of natural resources. Thus, food security encompasses the entire development spectrum, as well as sustainabile development.

1.1.3 Data, Methodology And Limitations

Data

This study is mainly based on secondary data collected from various sources. Data was analysed at four levels: national, provincial, commune and household. At all levels, the data contained inconsistencies, incompatibilities and was often unrepresentative. Most of the data was incomplete, valid at a particular time, or for a few thousand households. Some of the data quoted

at the national level was compiled from sample surveys, such as the Cambodia Socio-Economic Surveys (CSES) of 1997 and 2004, as well as the Cambodia Demographic and Health Survey (CDHS) of 1999-2000. Information was also taken from the 1998 Population Census. In addition, the study relied on publications of various kinds that provided a broad picture of conditions at the ground level. Some of the data was generated by case studies. Thus, there was no uniformity of data, and comparisons between periods were not possible due to the lack of information. Despite these limitations, the available data was put together to highlight existing gaps and the need for more representative follow-up surveys.

The data at the provincial level was mainly sourced from the United Nations Food and Agriculture Organization and the Royal Government of Cambodia. A number of other sources were also used. Information was also gleaned from maps based on geographical information systems and other publications. Inconsistencies have been highlighted while analysing the data. Most of the estimates at the provincial levels were either based on the 1998 Census, or taken from the sample surveys conducted in 1997 and 2004.

Data at the commune level, including the percentage of people below the poverty line, was made available by the World Food Programme (WFP). The per capita rice production at the commune and province level was estimated from the sample crop-cut survey data of 2004, which was also made available by the World Food Programme. Information on adult literacy and school enrolment was available to us from the 1998 Census. The percentages of moderately stunted and underweight children were taken from the Cambodia Demographic and Health Survey (CDHS).

The CSES 2004 was the source of the household-level information. A partial data set pertaining to 8,986 households was used for analysis mainly in an attempt to capture transient food insecurity. The results were broadly indicative of the problems and causes of seasonal food consumption. We have used the household sample to estimate coefficients that explain the correlates of poverty.

Household-level information was also used from the CDHS 1999-2000. Although the data was not representative at the sub-national level, it was used to gain an understanding of the factors that had an impact on the incidence of underweight in children below the age of five. Since reliable quantitative data were limited, the study was supplemented with available qualitative information.

Information from other organisations, such as the World Food Programme (WFP), the Food and Agriculture Organization (FAO), the United Nations Development Programme (UNDP), the Department for International Development, UK (DFID), the World Bank (WB), the Asian Development Bank (ADB), the Australian Agency for International Development (AusAID), Helen Keller International and the Japan International Cooperation Agency (JICA) was also used. Organisations such as the Cambodia Development Resource Institute (CDRI) and the Cambodian Rice Research Institute (CRRI) also provided valuable information. Discussions with government officials, several key officials of donor organisations and consultants provided a national perspective.

Since the study had to rely on information with gaps and inconsistencies - sometimes not comparable and at times unreliable - the conclusions are at best indicative and are not definitive; they require further rigorous investigation in some areas. All the same, we hope that the report not only creates awareness about the problems of food security but also helps to find long-lasting solutions.

Methodology

The three dimensions of food security - food availability, food access and food absorption - were studied with the help of indicators. Analysis was undertaken at four levels – national, provincial, commune and household levels. The analysis at the national level was undertaken to understand the overall situation and its implication as far as national policies are concerned. Analysis at the provincial level sought to understand how each province fared in relation to the various aspects of food security. The variations across the provinces helped in

understanding the causes of food insecurity. At the provincial level, the chosen food security indicators were analysed and mapped to provide a better visual understanding of problem areas. Some of the maps also provide valuable geographical information, although the period of reference is more than a decade old.

Analysis at the commune level had data limitations. However, the study used six indicators, covering the three dimensions of food security - availability, access and absorption - and identified the most food insecure communes with the help of a Food Security Index. Commune maps of six indicators and a composite index have been presented.

Food and cereal consumption data were analysed at the household level to gain some insights into the household level problems of food consumption. A rigorous analysis of seasonal variations in food consumption was not possible due to time constraints. Yet certain interesting relationships between the low value of consumption and other household factors could be established. Similarly, the correlates of underweight children were studied with the help of the CDHS 2000 survey data.

Unfortunately, there was no systematic correspondence between the four levels – national, provincial, commune and household – either in terms of analysis or comparability of data, due to the lack of uniformity in the data sets.

To derive the final Food Security Index of Cambodia, some key indicators at the sub-national level were singled out for inclusion in the final index and sub-indices. The choice was based on a-priori reasoning, as well as on the correlations that existed between the indicators; a strong correlation made one indicator a substitute for the other. Sometimes, related indicators were used if they were important. The chosen indicators were once again tested for possible clustering and component formation with the help of principal component analysis. Finally, the robust and relevant indicators were included in the calculation of the final Food Security Index. The provinces were ranked and mapped from one to 24 in the order of increasing food security.

For the purpose of analysis, apart from indexing, simple statistical tools, such as multiple regressions, time trends, an instability index and a diversification index were used. The task being only to describe the status of food security as it appears today in Cambodia, no attempt was made to build a food security model for the country.

Limitations

The study facilitates a better understanding of the issues relating to food security and seeks to increase the awareness of issues that need urgent attention. Since food security forms the central issue, the study focused more on agriculture and rural areas, rather than on urban areas, industrial development, or the macroeconomic profile of the country. This is not to underestimate the importance of urbanisation and industrialisation or the shift of employment to industry and services. Macro-level development issues are no doubt important, but the emphasis on rural areas underscores the point that a country that is predominantly rural has to first ensure that its rural population is well provided for.

As mentioned earlier, the data used has limitations in terms of quality and reliability. Further, the indicators selected and the method of calculating the Food Security Index has its own limitations. In a similar manner to the Human Development Index (HDI), the Food Security Index also has an aggregation bias. Thus, more emphasis is placed on individual indicators and the narrative of the situation, rather than on the final index. The information contained in the Atlas, however, could form the basis for further research.

1.1.4 Organisation of the Study

This study is organised into six chapters. After the Introductory Chapter, Chapter Two focuses on food availability. To assess the adequacy of food availability, given consumer preferences, it begins with a description of present food production. The chapter looks at the problems of production and prospects for the future, and features a detailed account of the natural resource base of the country. Chapter Three examines food and livelihood access at the national and provincial levels. It

deals with the levels of poverty, unemployment, literacy rates, educational attainments, non-agricultural population, etc. at the provincial level. Some of the factors that have an impact on poverty have been analysed. The problems of land ownership and access to natural resources, such as forests and water, have also been studied. The household-level analysis helped to understand the impact of various factors on food consumption and poverty. Chapter Four, on food absorption and nutritional security of the population, explains how the latter has a bearing on the status of health, health infrastructure, sanitation and safe drinking water. The fourth section in the chapter assesses the determinants of underweight in children with the help of CDHS data. Chapter Five provides the composite sub-indices and the final Food Security Index. It also maps the final Food Security Index and ranks the provinces and municipalities. Chapter Six brings into focus issues of concern regarding food security and the existing polices and programmes of the Royal Government of Cambodia, as well as policy recommendations.

1.1.5 An Overview of the Cambodian Economy

Cambodia is surrounded by countries that are Southeast Asian success stories. With its rich natural resource base, low population density and potential to attract investors, Cambodia has an excellent opportunity to become a prosperous country.

An evaluation of Cambodia's performance in recent years by the International Monetary Fund (IMF) has shown a tremendous improvement in GDP growth by about 6-7 percent during 1999-2003. The contribution of agriculture to GDP during the period was about 30 percent. Growth in agriculture, though, was quite uneven, changing from 2.6 percent in 2001, to -0.09 percent, in 2002 and to - 4.2 percent in 2004. In between, however, the growth rate shot up to 8.2 percent in 2003; it has so far recorded a growth of 4.1 percent in 2005. Though the average rate of growth for the period is impressive, fluctuations in growth have had negative consequences for the population. Indeed, the fluctuating production of staple foods has had implications for sustainable food security in Cambodia. The industrial and service sectors, which engage a smaller percentage of the total population, have done well in recent years. Most of the growth has been attributed to garment exports, tourism and large aid inflows. The 1996 trade agreement, featuring a huge reduction in the U.S tariff on garments produced in Cambodia from 50-70 percent to 10-20 percent, led to a boost in apparel exports attracting many foreign investors. According to Cambodia Economic Watch 2004, the industrial sector grew at 9.6 percent in 2003, while growth in the service sector slowed to 2.9 percent. Foreign finance constituted 6.0 percent of the GDP in 2003. Apart from external aid, domestic revenue constituted about 10.4 percent of GDP in 2003. The external current account deficit widened by 0.8 percent to 2.4 percent of GDP in 2003 due to increasing merchandise imports, lower tourism receipts and higher petroleum prices. Cambodia became a member of the ASEAN in 1999 and a member of WTO in 2004, in an attempt to integrate itself into the Southeast Asian and global economy.

Cambodia's development prospects have to be seen against the background of past disruption to economic and social life. Since peace returned to Cambodia in 1992, economic growth has been very high. Even so, it would appear that growth remained concentrated in ceratin sections of the population and did not fully trickle down to the rural poor. Moreover, growth cannot be sustained without investments in people, institutions, basic services and safety nets. The following chapters examine the prerequisites for food security and sustainable development.

CHAPTER - 2

Food Availability

CHAPTER 2

Section A

Food Availability and Adequacy

This chapter is in two sections: Food availability and adequacy in section one and the natural resource endowments of the country and the prospects of sustaining staple food production in section two. The first section deals with food production and food shortages. It also examines food adequacy in terms of production, as well as consumption. The second section deals with the status of natural resources, such as land, water, and forests. The prospect of production has been examined in detail given natural endowments and technological advancements.

The availability of food is important at the national, as well as sub-national levels. In food production, we consider staple crops, as well as oil seeds, vegetables, fruits, milk, meat, poultry, and fish, etc. Strictly speaking, the country need not produce all types of foods. Food can be imported to augment availability. However, domestic production of food is advantageous when a large percentage of food consumed is already locally produced. It helps livelihoods and enhances food availability at the local level.

Cambodian agriculture contributes about 30% to the GDP of the country. About 74% of the population is engaged in agriculture.[1] Cambodia needs to be self-sufficient in the production of staple food if it is to achieve long-term food security. A population density of 64 persons per square kilometre is not high compared to most of Asia. Cambodia is also well endowed with natural resources.

2.1 Food Production

The food production of cereals, pulses, oilseeds, fruits and vegetables, sugar, milk, meat, fish and eggs is examined. These items constitute a balanced diet. Production and consumption of these items in the country may be adequate at the national level. However, there could still exist deficient consumption among populations at income levels below the poverty line, as well as transient food shortages in some parts of the country, due to either disasters, such as floods and droughts or infrastructure bottlenecks that hamper the distribution of food.

The data used in this study is taken from the figures quoted by the Food and Agriculture Organization (FAO), which normally uses government sources. However, there seem to be some discrepancies in the production data for a few years between these two sources. The exact sources of production and consumption data are not known. Data may have been collected through the village chief or provincial government in some years. In the absence of other sources, the crop-cut survey has been used to estimate rice production in the year 2004.

[1] As per the Inter-Censal Population Survey of 2004, the share of primary sector consisting of agriculture, forestry fishing and hunting was 74 % and it has declined from 77% in 1998. However, as per Royal Government of Cambodia 2002, quoted in Gill J, Gerard, , Luttrell, Cecilia and Conway, Tim "Food Security in Cambodia" working papers, it was estimated as 82%. As per the Inter-Censal Population Survey of 2004, agriculture, forestry, fishing and hunting was only 74 % and it has declined from 77% in 1998.

2.1.1 Production Trends

The area of production and yield of total cereal production has shown a significant increase in the decade between 1994 and 2004. From about 2.2 million tonnes in 1994, production increased to 4.18 million tonnes. The annual compound rate of growth of production was 5.3%. In addition, there has been a significant rate of growth in area under cultivation, as well as yield. The contribution of yield growth to production growth was 53% and that of area growth was 47%.

The growth in cereal production occurred with respect to all cereals: rice and coarse grain, as well as maize. Rice production has shown a growth rate of 5%, no doubt due to a significant improvement in yield, but area increase also made a substantial contribution to production. The contribution of yield growth at 2.7% was only marginally higher than the contribution of area growth at 2.3%. The absolute level of yields for rice was not very high. The average for the country was about 2,000 kg/hectare in 2003. This shows that there is scope for further increase in production through yield improvements. Maize, coarse grain, roots and tubers have shown a significant increase in production as well (Appendix 1.1).

There was a significant increase in the production of pulses, roots and tubers, certain fruits, such as limes and oranges, and oilseeds, like soybeans and groundnuts. The production of sugarcane and the production of fibres recorded a negative growth rate mostly due to yield and area fluctuations. In respect of other animal foods, such as eggs, meat and fish, the rates of growth were small but significant (Appendix 1.2 and Appendix 1.3).

Provincial-level production data shows that for rice there was a significant growth in 16 out of 24 provinces and municipalities between 1993 and 2003. The production growth was significant only for five provinces in the case of maize, seven provinces in the case of mung beans, three provinces in the case of cassava and only one province for potatoes. We have looked at the production growth of other cereal substitutes as well, as they are important sources of on-farm consumption. The emphasis, though, was mainly on rice (Table 2.4 and Appendix 2.1) (Map 2.1).

Yields of crops are currently low in absolute quantities. Basic support systems to agriculture, such as inputs, market links, infrastructure and value addition in food processing is lacking. Cambodian agriculture has a large potential for improvement, and has to achieve high levels of yields to effectively compete with its neighbouring countries. It is important, therefore, to sustain current levels of growth.

Between 1993 and 2003, there was a substantial improvement in food production, although production declined in 2002 and 2004[2]. However, one has to look at the progress in the context of the country, torn by decades of conflict, coming back to near-normal conditions. This has helped people to settle down in their main occupation, agriculture. In addition, the international price of rice has slumped since 2001, making rice production less profitable. It was found that, in value terms at constant prices, the production of rice was lower in 2004 compared to that in 2003[3].

2.1.2 Fluctuations in Staple Food Area Production and Yield

The implications of fluctuations in production are different from fluctuations in prices. A decline in production would mean that the per capita availability at the local level would decline. This may lead to non-availability of the staple food in the lean seasons. It may result in transient hunger as in the case of drought years in certain parts of the country. It may also mean lower amounts of rice being sold in the market, resulting in lower cash incomes to farmers.

Weather fluctuations that occur every year differ from one part of the country to the other. Rainfall, humidity, loss due to pests, floods and droughts and fluctuations in the sown area due to price changes are all reflected in final production. Whatever the cause, when incomes dip and availability is low, poorer sections of the population and subsistence farmers face food shortages. Crop production fluctuations lead to transient food shortages that are seasonal in nature. These production fluctuations are termed instability, and are important to study in Cambodia.

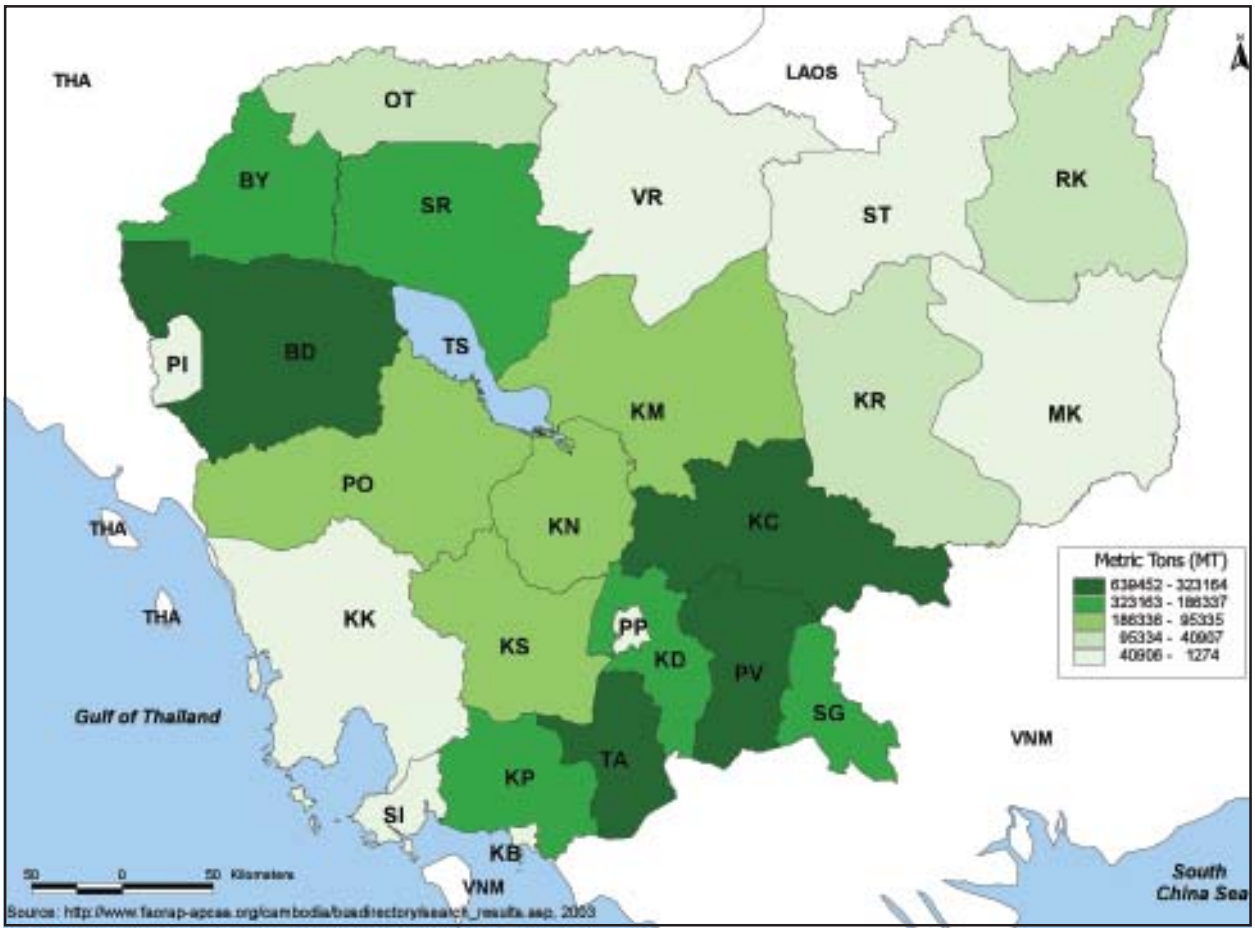
[2] Economic Institute of Cambodia "Cambodia Economic Watch" October 2004

[3] Refer to the table no. 3.3 in the third chapter.

Instability in crop production is measured in different ways. The basic method consists of measuring changes in production around the trend value.[4] The method followed in this study is a variation of this basic method. The standard deviation of annual growth rates is taken as a measure of instability. When annual growth is steady, instability is minimal. When annual growth moves widely, instability is high.[5] First, the natural logarithm of the production, area or yield for each year is taken. Then the difference between the current year and the previous year is computed. The first difference, computed as a natural logarithm, is the annual growth rate. The standard deviation in the annual growth rate measures the instability–the higher the percentage, the larger the instability and deviations from the trend line. This method does not require one to de-trend the time series crop data. It is simpler and more effective. It does not assume a trend equation, which may be a poor fit to the data at times.

The instability in production and yield of rice and maize were computed to study the levels of instability. The results show that cereal production in Cambodia experiences fairly higher levels of instability compared to many other countries of Asia, including India. Especially for rice, many countries show very low instability as the crop is mostly irrigated. For Cambodia as a whole, maize output has higher instability at 35% compared to rice instability at 16%. For both maize and rice, production instability was higher than yield

Map 2.1 - RICE PRODUCTION



[4] Hazel, Peter "Instability in Cereal Production" 1985.

[5] Vepa .S, Swarna " Pulses In India", Thesis submitted to the University of Delhi, (Mimeograph) 1998. Also see C.H. Hanumantha Rao, and S.K. Ray, " Instability in Indian Agriculture", Vikas Publishing House, New Delhi 1989

Table 2.4 - Decadal Growth Rate of Food-Grains in Cambodia by Province (1993-2003)

No		Location	Rice	Maize	Mung-bean	Cassava	Potat-oes	Soyb-ean	Pea nut	Sesa-me	Sugar-cane	Vege-tables	Jute	Toba-cco
1	p	Banteay Meanchey	7.67**	40.92**	35.74**	-0.47	-7.34		14.78*	9.02	-7.08	2.38	-15.32	
2	p	Battambang	6.88**	64.56**	20.65**	30.66*	4.68	64.65**	17.26**	54.22**	6.85	2.54	-24.93	
3	p	Kampong Cham	6.87**	0.37	-2.94	18.68**	-3.39	1.57	11.22*	14.95*	-0.55	10.98	-13.9	-1.79
4	p	Kampong Chhnang	7.18**	-3.87	-1.03	0.75	-2.85		1.49	-18.76	-8.18	0.92	-21.58	-16.93
5	p	Kampong Speu	4.43*	-0.59	13.08*	18.93	1.40		5.07	-0.38	10.43	-2.81		
6	p	Kampong Thom	3.68*	4.97	0.63	3.82	-3.06	-0.97	11.68	22.27**	2.22	-5.60	-24.94	
7	p	Kampot	6.09*	8.03**	26.92*	-5.70	-6.80		16.06**	13.16*	7.75	-10.26		
8	p	Kandal	4.89	-4.18	5.71	-7.01	-3.38	-8.74	-4.45	7.77	-1.64	-5.77	-5.36	-39.86
9	p	Koh Kong	6.34**	9.92*		4.82	-6.22				4.83	-11.88		
10	p	Kratie	7.02**	4.48	-9.69	7.98	-9.26	1.98	15.95*	13.46*	6.86	-7.50		-7.55
11	m	Kep	4.21	-10.56		-6.17	-6.77		-8.08			17.49		
12	m	Pailin												
13	m	Sihanoukville	6.36*	28.51*		7.96	0.43				2.51	7.34		
14	p	Mondul Kiri	10.17**	-21.05	21.88*	-9.28	-21.29	-2.66	25.95		5.63	-21.41		
15	p	Oddar Meanchey												
16	m	Phnom Penh	2.87	2.99		0.49	20.08			11.15		-0.18		
17	p	Pursat	6.73**	7.75	-7.15	12.62	12.12		6.13	10.81	-0.50	-7.01		
18	p	Preah Vihear	1.87	4.73	33.55*	17.61*	2.91		48.91**	42.25*	18.79	-6.25		
19	p	Prey Veng	6.99*	-7.58	-1.94	-19.69	-11.74		-4.26	19.16*	-16.68	-0.48		-50.01
20	p	Ratanak Kiri	8.41**	20.41	19.53*	5.43	13.39	36.01	33.77	23.07	-15.13	14.88		
21	p	Siemreap	2.90*	4.94	13.15	7.54	0.55			14.43	3.11	-2.97		
22	p	Stung Treng	10.48*	5.67	9.11	-3.10	5.49		12.76	5.29	-0.73	-2.22		22.95
23	p	Svay Rieng	4.07	-4.11	-13.02	-0.50	12.18**				-2.49	-7.49		
24	p	Takeo	5.56*	-5.93	-6.88	-10.05	-12.31		-7.41	-42.51	-10.07	-10.23		

Source: Based on the crop production data for Cambodia given by FAO.
Original Data Source: http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp
** Significant at one percent level
* Significant at 5 % level
Note: Data for some years was not available for some crops, the details are given in Appendix 2.1.

instability. Yield instability was about 8% for rice, but as high as 24.8% for maize. Obviously, for upland crops, such as maize, instability is higher than that of crops such as rice, which receive assured moisture, either from receding floodwaters, irrigation or proximity to water bodies. The instability in yield at the national level is often lower than the instability at the provincial level. This is because regional yields move in different directions and compensate for each other, bringing down overall instability. However, it is the regional instability in staple food production that causes the transient hunger problems of a seasonal nature. Hence, we have calculated the provincial-level instability in rice and maize production in Cambodia (Table 2.5 & Table 2.6) (Map 2.2).

At the provincial level, there was a high level of instability in both the cereal crops. However, the maize crop was far more unstable than the rice crop. Production is far more volatile than yield. For rice, there was considerable variation in the level of instability between the provinces. The provinces of Stung Treng, Prey Veng, Takeo and Kampong Speu had high instability, exceeding 25%, in rice yield. These provinces have shown a high level of instability in rice production as well, ranging between 49% and 67%. Kandal has also shown a high level of instability in rice production instability, at 61%. These provinces are likely to experience higher levels of transient food shortages and hunger and food insecurity when production dips. However, the average production could still be high making these provinces look food secure. Phnom Penh, Kampong Cham and Pursat have shown relatively stable levels of rice yields with lower levels of instability, between 10% and 13%.

The degree of instability was much higher in the case of maize. The province of Battambang has shown highly unstable yield and production for maize, with about 40% yield instability and about 94% production instability of maize, which is very high by any standard. Kratie, Kampong Chhnang and Svay Rieng showed high instability in maize yield, whereas Kampong Cham and Takeo had high fluctuations in maize production. Phnom Penh and Kampot had relatively lower levels of instability. Instability in staple foods may cause hardships to those dependent upon local production in years of low production or crop failure.

Table 2.5 - Standard Deviation of Annual Growth Rates

No	Crop	Instability (STD of Annual Gr. Rates)
1	Rice Area	0.10
2	Rice Production	0.16
3	Rice Yield	0.08
4	Maize Production	0.35
5	Maize Yield	0.25

Source: Ministry of Water Resources and Meteorology.
http://www.faorap-apcas.org/cambodia.
STD - Standard Deviation.

2.1.3 National Food Adequacy

As per the cereal production and population data of 1998, about 261 kg of rice was produced per person per year, even after deducting about 15% towards seed, feed and wastage.[6] Though some of the urban areas and provinces are deficient in production, overall rice production is sufficient to cover the consumption requirements of the population. Other cereals and cereal substitutes, such as maize, cassava, potato and soybean add to staple food availability. Thus, basic foods that give adequate calories per person are produced in sufficient quantities. The net cereal production is estimated at 715 grams per capita per day at the national level in 1998. The net cereal production in 2004 is estimated at 981 grams per day (Table 2.7).

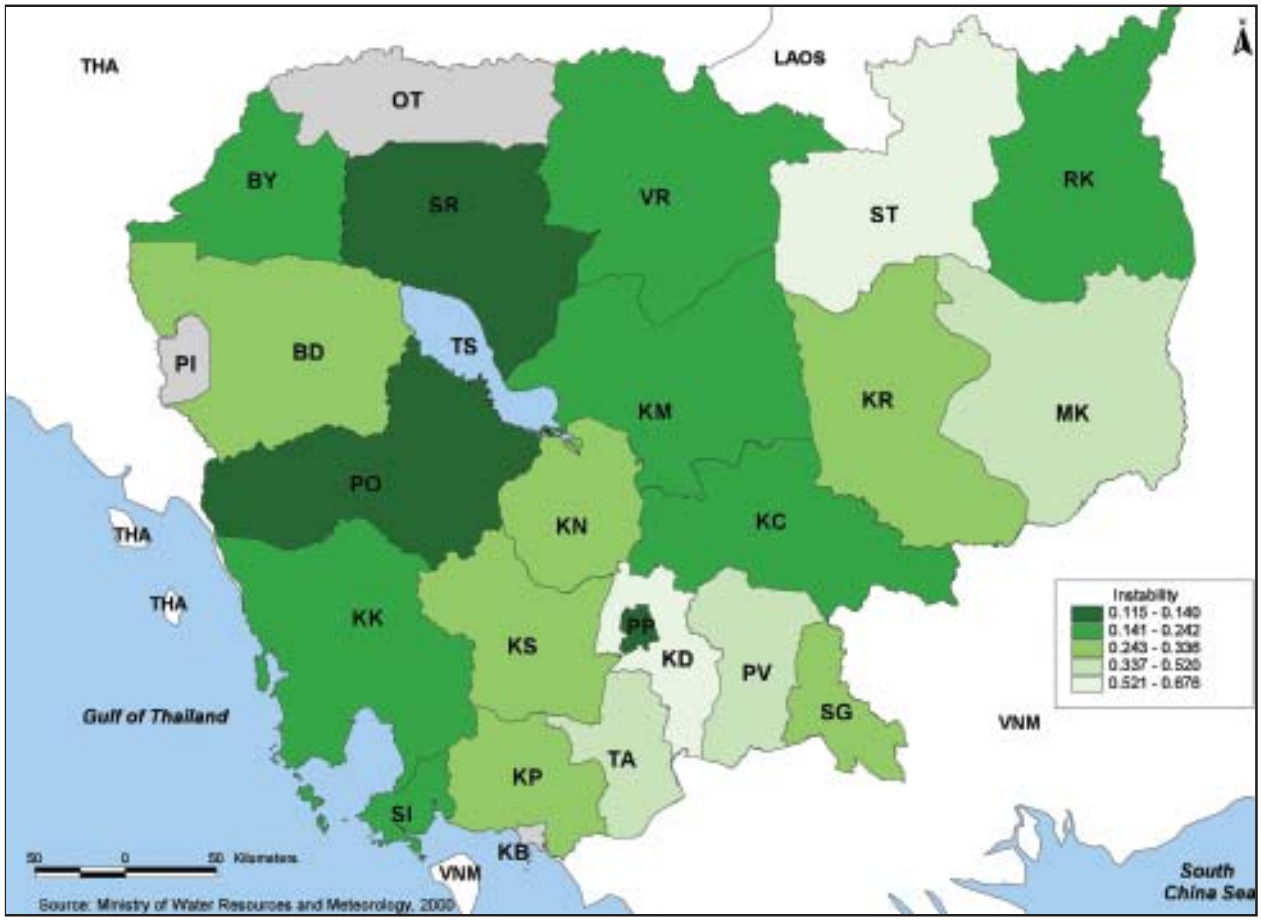
Some information on the consumption of paddy is available from the government web site, though the source of data, reference period and methods of estimation are not known. It shows that though paddy

[6] The data pertains to rice equivalents of paddy production, which is adjusted for loss in weight during husking of paddy. Even though a large percent of post-harvest losses have been expected, the recent 2004 quick estimates of socioeconomic data show post-harvest losses at the household level for rice as low as 3-4%. See the table 3.13 in the third chapter. Since commercial losses are expected to be higher we have arbitrarily put the seed, feed and wastage at 15% of rice production equivalents.

Table 2.7 - Change in the Net Cereal Production, 1998-2004				
No		Province/ Municipality	Per Capita Net Cereal Production (gms/day) 1998	Per Capita Net Cereal Production (gms/day) 2004
1	p	Banteay Meanchey	966.94	1554.55
2	p	Battambang	983.62	2546.23
3	p	Kampong Cham	517.16	693.80
4	p	Kampong Chhnang	767.72	938.90
5	p	Kampong Speu	456.12	235.23
6	p	Kampong Thom	825.83	729.68
7	p	Kampot	836.48	705.66
8	p	Kandal	175.88	792.31
9	p	Koh Kong	158.04	461.56
10	p	Kratie	312.36	604.58
11	m	Kep	307.71	893.16
12	m	Pailin	0.00	2098.41
13	m	Sihanoukville	226.85	529.35
14	p	Mondul Kiri	382.01	273.59
15	p	Oddar Meanchey	N/A	835.88
16	m	Phnom Penh	29.81	162.89
17	p	Pursat	803.72	915.73
18	p	Preah Vihear	354.88	779.84
19	p	Prey Veng	702.54	1096.20
20	p	Ratanak Kiri	504.95	899.08
21	p	Siemreap	766.71	798.30
22	p	Stung Treng	556.18	880.90
23	p	Svay Rieng	756.21	1302.34
24	p	Takeo	826.09	1796.09
		Cambodia	714.63	981.49

Source: http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp
Data was computed from 1998 Population Census of Cambodia and 2004 Crop Cut Survey given by WFP.

Map 2.2- RICE PRODUCTION INSTABILITY



production is unevenly distributed across the regions, consumption is more evenly distributed. Thus, on average, the data does not show any consumption shortage in 1998 (Table 2.8) .

Thus, cereal production and consumption appear to be adequate at the national level, showing that the country is self-sufficient in cereal production on average. Cambodia has become a net exporter of rice in recent years. Expansion of rice exports appear to be lagging behind its potential. The official reported exports have been lower than the estimated real exports. The exports to neighbouring countries are said to be much more than what is being reported. For example, total exports, including illegal exports, have been estimated at US $111 million, while reported exports were only worth US $0.6 million in the year 2003. Exports have been encouraged by the government by removing export barriers. Yet sale without export duty has clearly been more attractive to the buyer, with rice having been sold to Vietnamese and Thai traders across the borders[7].

This has two implications. On the one hand it may lead to distress sales, low profit and low incentives for improving yields. The monopoly of trade over production leads to a loss of bargaining power to the farmers. In addition, the lack of quality control denies farmers access to new and remunerative markets.

[7] Economic Institute of Cambodia "Cambodia Economic Watch" October 2004.

Table 2.7 - Change in the Net Cereal Production, 1998-2004

No		Province/ Municipality	Per Capita Net Cereal Production (gms/day) 1998	Per Capita Net Cereal Production (gms/day) 2004
1	p	Banteay Meanchey	966.94	1554.55
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5	p	Kampong Speu	456.12	235.23
6	p	Kampong Thom	825.83	729.68
7	p	Kampot	836.48	705.66
8	p	Kandal	175.88	792.31
9	p	Koh Kong	158.04	461.56
10	p	Kratie	312.36	604.58
11	m	Kep	307.71	893.16
12	m	Pailin	0.00	2098.41
13	m	Sihanoukville	226.85	529.35
14	p	Mondul Kiri	382.01	273.59
15	p	Oddar Meanchey	N/A	835.88
16	m	Phnom Penh	29.81	162.89
17	p	Pursat	803.72	915.73
18	p	Preah Vihear	354.88	779.84
19	p	Prey Veng	702.54	1096.20
20	p	Ratanak Kiri	504.95	899.08
21	p	Siemreap	766.71	798.30
22	p	Stung Treng	556.18	880.90
23	p	Svay Rieng	756.21	1302.34
24	p	Takeo	826.09	1796.09
		Cambodia	714.63	981.49

Source: http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp
Data was computed from 1998 Population Census of Cambodia and 2004 Crop Cut Survey given by WFP.

Table 2.8 - Production and Consumption Deficit (kgs/capita/year)

			1	2	3	4	5	6	
No		Province/ Municipality	Rice Consumption	Gross Rice Production	Net Rice Production	Deficit Over Consum-ption	Deficit Over National Avg. Consump-tion	Consumption Fish/Meat	
1	p	Banteay Meanchey	210.00	415.22	352.93	142.93	122.93	9.00	7.20
2	p	Battambang	223.40	422.38	359.02	135.62	129.02	43.5-75.6	15-30
3	p	Kampong Cham	223.00	222.08	188.76	-34.24	-41.24	4.00	0.93
4	p	Kampong Chhnang	224.00	329.67	280.22	56.22	50.22	39.23	3-4
5	p	Kampong Speu	223.00	195.86	166.49	-56.51	-63.51	15.00	20.00
6	p	Kampong Thom	240.00	354.62	301.43	61.43	71.43	NA	NA
7	p	Kampot	223.43	359.19	305.32	81.89	75.32	11.00	13.20
8	p	Kandal	225.00	75.53	64.20	-160.80	-165.80	40.00	4.80
9	p	Koh Kong	224.00	67.86	57.68	-166.32	-172.32	NA	NA
10	p	Kratie	223.00	134.13	114.01	-108.99	-115.99	45.00	8.00
11	m	Kep	320.00	132.14	112.32	-207.68	-117.68	21.22	3.65
12	m	Pailin	224.00	0.00	0.00	-224.00	-230.00	34.70	108.00
13	m	Sihanoukville	223.00	97.41	82.80	-140.20	-147.20	45.00	8.00
14	p	Mondul Kiri	NA	164.04	139.43	-89.98	-90.57	NA	NA
15	p	Oddar Meanchey	223.40	N/A	N/A	-223.40	-230.00	48.00	3.30
16		Phnom Penh	223.43	12.80	10.88	-212.55	-219.12	10.95	25.00
17	p	Pursat	224.00	345.13	293.36	69.36	63.36	40-45	36.00
18	p	Preah Vihear	224.00	152.39	129.53	-94.47	-100.47	36.50	36.50
19	p	Prey Veng	245.00	301.68	256.43	11.43	26.43	11.20	4.92
20	p	Ratanak Kiri	--	216.83	184.31	-45.10	-45.69	--	--
21	p	Siemreap	224.00	329.23	279.85	55.85	49.85	40.00	4.00
22	p	Stung Treng	230.00	238.83	203.01	-26.99	-26.99	42.00	NA
23	p	Svay Rieng	224.00	324.72	276.02	52.02	46.02	25.00	30.00
24	p	Takeo	223.43	354.73	301.52	78.09	71.52	37.00	37.00
		Cambodia	229.41	306.87	260.84	31.43	30.84	28.60	20.62

Source: Column 1 & 4, Ministry of Agriculture, Forestry and Fisheries, Cambodia: www.maff.gov.kh/provinces/...Accessed on 11 April 2005. Column 2, 3 & 5, http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp and 1998 Population Census of Cambodia.

Alternatively, given the background of poor market linkages and infrastructure that exist within the country, it could be viewed as an assured market that provides an incentive to production.

2.1.4 Transient Food Shortages and Inadequate Consumption

Self-sufficiency in production at the national level does not ensure that the poorer sections of the population consume adequate calories. It depends upon a number of factors, such as prices, incomes, local availability, seasonal and year-to-year fluctuations. Data on the quantity of consumption of cereals by the lower deciles is not available even at the national level. The 2004 CSES[8] also did not collect information on the quantity of consumption, at least through the recall methodology used.

However, there is sufficient evidence of seasonal variations in food consumption in rural Cambodia. The analysis of two sets of data for Cambodia, for 9,000 households spread over 9 months from November 2003 to July 2004, and for 15,000 households over 15 months ranging from November 2003 to January 2005, show that the value of average per capita consumption per day for the former sample is lower at 1,829 Riels per capita per day than the latter at 1,932 Riels. The difference appears to be small at the national level but is likely to be pronounced in certain provinces and for certain sections of the population.

Rice is grown during the monsoon season in lowlands and uplands. It is also grown in the floodplains after the flood recedes, utilising residual moisture. The harvest season for the various varieties of rice crop, ranging from lowland flooded areas, upland and irrigated areas, is approximately spread over four months from October to January. Hence, these months could be expected to show higher levels of availability and consumption at the local level in rural areas.[9]

A World Bank analysis of seasonal variations in the value of consumption, adjusted for broad price variations across rural and urban Cambodia, also clearly shows that in certain months consumption is lower than in others.[10]

At the provincial level, seasonal food shortages would likely be more pronounced in the drought years. An analysis of the sub-national level data for the Asia-Pacific region has also shown that the poor in lower income deciles consume diets deficient in calories in food production-deficit regions.[11]

Provincial-level Food Shortages

A province need not be self- sufficient in the production of staple foods if the country has adequate availability. However, sometimes, in the sub-national regions, a deficit in local production, coupled with the lack of distribution networks, lower purchasing power and infrastructure bottlenecks may lead to seasonal shortages of staple foods. To study if rice production is adequate at the local level, we have calculated the per capita production of various crops in the 24 provinces, using the 1998 Census production data. The 1998 data was used since the population totals at the provincial level are reliable. We are aware that since 1998 both population growth and production growth have taken place and the per capita availability of staple foods improved substantially. The present analysis is only indicative of the possible shortage of staples in certain areas.

Some rural provinces, such as Kandal and Koh Kong, are deficient in rice production, compared to their population. However, they produce more maize, cassava, sugar cane and vegetables. There are other rural provinces, such as Prey Veng and Stung Treng, where rice production is less than the national average of 261 kg per person per year. Production per person

[8] A socio-economic survey of 15,000 households was conducted in 2003-2004. Out of that the data for 9,000 sample households were made available for analysis. The present figure is the unweighted average for the sample spread over all the 24 provinces.

[9] Detailed discussion of the rice varieties is included in the second section of this chapter.

[10] World Bank Report on "Cambodia Poverty Assessment" section on "Analysis of Seasonal Variations in Consumption"(Draft Report) Courtesy World bank, Washington D C.

[11] Vepa .S, Swarna, "Halving Hunger by 2015: A Frame work for Action in the Asia- Pacific Region" Commissioned paper by UN Task Force on Hunger, (Mimeograph) August 2004.

was less than 200 kg per year in Kampong Cham, Kampong Speu, Kandal, Koh Kong, Kratie, Mondul Kiri and Ratanak Kiri. (Table 2.8).

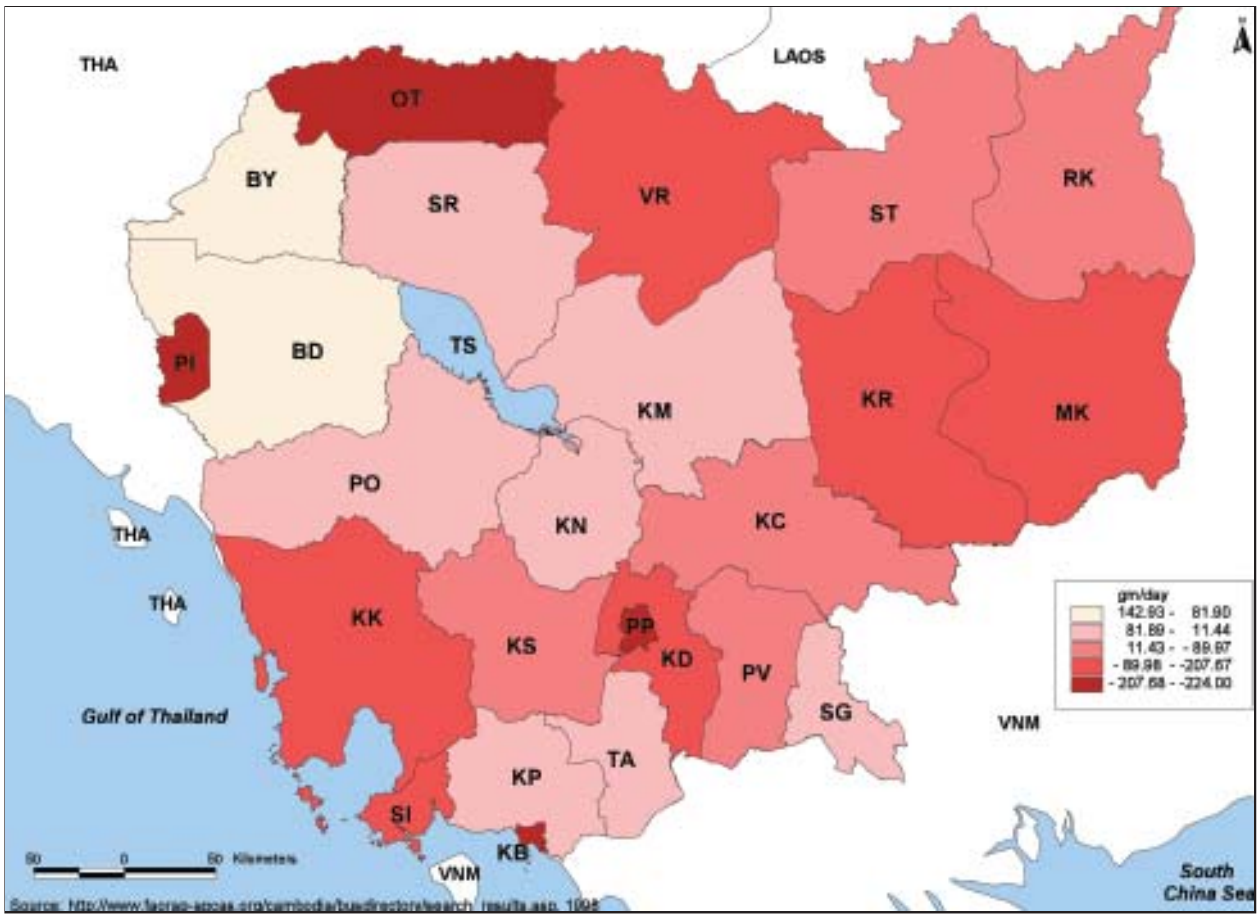
Other municipal administrative areas such as Phnom Penh, Sihanoukville, Kep and Pailin are non-agricultural areas, and hence there is a deficit in the production of rice per capita. However, urban areas would not normally experience any food shortages. The private trade distribution network is well established in these areas due to higher demand. Some studies seem to indicate that Cambodia's main problem today may be more related to income poverty and the provision of basic health care, etc.[12] (Map 2.3)

2.1.5 Crop Area Diversification

Diversification refers to growing different crops in a given area of land and not just relying on a single crop such as rice. For Cambodia, which depends on subsistence farming, diversification is important to make farming profitable and to ensure that agriculture engages more people per land area. It is also important to produce a variety of essential food items within the country to safeguard the country's sovereignty.

Diversification has several other advantages, especially in a predominantly subsistence agriculture. It reduces production risk, acting as an insurance against crop failure. For instance, deficient rainfall and changes in the distribution of rainfall may affect the entire

Map 2.3- PER CAPITA DEFICIT OF CEREAL PRODUCTION OVER CONSUMPTION



[12] Murshid, K.A.S "Food Security in an Asian Transitional Economy - The Cambodian Experience", Cambodian Development Research Institute, Cambodia, 1998.

production of a mono-cropping farmer. A farmer with multiple- cropping would lose only one crop due to rainfall variations, since water requirements and seasonality of crops differ. When some crops fail others would survive. Thus, there is more stability in the farmer's income.

Diversification also improves soil fertility and soil conservation. Some crops such as rice deplete soil fertility, while others such as legumes replenish the soil. Growing many crops in an area is also beneficial to the farmer as it helps increase the variety of foods available. Diversification enables the addition of crops to the farming system that are of higher commercial value, thus enhancing the profitability of the sector. Livelihood opportunities also increase because of greater scope for agro-processing and other value-added industries. Diversification is thus essential for sustainable food security as it can improve both production as well as livelihoods. For the country, as a whole, diversification also increases the GDP, thus taking the country to a better economic position.

A measure that is used to calculate diversification is the Area Diversification Index (ADI).

$$ADI = \frac{1}{\sum_{i=1}^{n}\left[(a_i / \sum a_i)^2\right]}$$

where 'a_i' refers to the area harvested under crop 'i'. This is divided by the total harvested area of all crops and then squared. Finally, all these figures are summed and its reciprocal gives the Area Diversification Index (ADI).

From the available 2003 data for Cambodia's crops, the ADI has been calculated for the country and for each province. The 'i' here ranges from 1 to 12 for provincial data and for the country from 1 to 24. In the calculation of the country's ADI, fruits have also been included. The ADI for the whole country is approximately 1.41. This is not too high a diversification but not too low either. The ADI has also been calculated for the country using only 12 crops, as in the case of provinces, and it was found to be 1.29. The ADI for the year 1994 is found to be about 1.39 taking into account all 24 crops; it is 1.25 when only 12 crops are taken into account. A comparison between the 1994 and 2003 ADI shows an increase in the diversification but it is marginal. The harvesting area of tobacco, jute, potato and sweet potato is observed to have reduced between the two time periods.

Individual provinces, such as Kep, Kampong Cham and Pailin, seem to have a high ADI of 2.06, 2.06 and 3.28, respectively, as compared to the rest of the provinces. Around eight other provinces have a higher ADI than the ADI of the country. Overall, the picture does not seem discouraging, though there seems to be a larger scope for crop diversification along with value addition, which could pave the way for greater poverty reduction. The prospects of sustainable diversification of Cambodian agriculture and its impact on poverty reduction in rural Cambodia need to be further studied. We shall focus more on this aspect in the next chapter on Food and Livelihood Access. (Table 2.9 and Table 2.10)

Table 2.9 Crop Area Diversification Index - Cambodia

Year	ADI for 12 Crops	ADI for 24 Crops
1994	1.25	1.39
2003	1.29	1.41

Source: http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp http://faostat.fao.orgfaostat/collections?subset = agriculture

2.2 Fisheries in Cambodia

Fisheries are next in importance after crops in Cambodia. Fisheries production in Cambodia is from the inland (river, lake and flood plains) catch, marine fishing and aquaculture. The fishery sector accounted for nearly 12% of Cambodia's GDP in 2002 but has declined in recent years.

Table 2.10 - Area Diversification for the Year 2003 by Province

No		Province/ Municipality	ADI
1	p	Banteay Meanchey	1.221
2	p	Battambang	1.732
3	p	Kampong Cham	2.065
4	p	Kampong Chhnang	1.157
5	p	Kampong Speu	1.176
6	p	Kampong Thom	1.194
7	p	Kampot	1.186
8	p	Kandal	1.494
9	p	Koh Kong	1.248
10	p	Kratie	1.464
11	m	Kep	2.061
12	m	Pailin	3.285
13	m	Sihanoukville	1.098
14	p	Mondul Kiri	1.113
15	p	Oddar Meanchey	1.293
16	m	Phnom Penh	1.394
17	p	Pursat	1.071
18	p	Preah Vihear	1.607
19	p	Prey Veng	1.067
20	p	Ratanak Kiri	1.424
21	p	Siemreap	1.132
22	p	Stung Treng	1.508
23	p	Svay Rieng	1.021
24	p	Takeo	1.041
		ADI (Country)	1.293

Source: http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp.
Note: ADI - Area Diversification Index.

Cambodia is rich in fresh water resources with rivers such as the Mekong, Tonle Sap Bassac and the Tonle Sap Lake (Great Lake). The Great Lake plays a vital role in the production of fish with around 60% of the country's freshwater fish being produced in this region. Fishing is practised in two seasons in the Great Lake: the closed season (June to September) and the open season (October to May). In the case of the open season, there is no limit to the number of operators who can fish. The closed season refers to a period when hunting or fishing for a particular kind of fish is prohibited by law.[13]

Inland fisheries are based on capture techniques in the Great Lake, its adjoining river systems and to a lesser extent, in flooded rice fields. The 450,000 hectares of flooded forests and shrubs growing in the Tonle Sap Lake shores are closely associated with fisheries.

Inland fisheries on average provide a catch of 230,000 tonnes of fish every year, a yield of 140-190 kg/ha.[14]Fresh water fish alone contribute about 1.8% to the GDP. Van Zalinge, however, suggests that the inland fisheries contribute about 3.2% to 7.4% to the GDP.[15] This shows the importance of freshwater fish in the lives of Cambodians as a major source of income. In recent years, the inland fish catch has fallen from 360,268 tonnes in 2002 to 308,750 tonnes in 2003. The inland fish catch did not show any substantial increase in 2004 either.[16]

Aquaculture based on introduced and indigenous species is practised in inland areas, although limited intensive and small-scale marine aquaculture is also undertaken. This is particularly important when it becomes a part of a wider farming system. Marine fisheries, involving the exploitation of resources by coastal fishers in inshore areas and by foreign fishers, also play a pivotal role in the country. The marine fish catch in 2004 was estimated at 55,800 tonnes.

[13] Fisheries Action Coalition Team (FACT) www.fact.org.kh/english/downloads_ online/fisheriesmanagement.pdf

1) Fish consumption in Cambodia

Traditionally, the consumption of fish has been high although it has fallen due to environmental degradation and population pressure. The people of Cambodia have a diverse food basket, with fish protein contributing about 40-60% of the total protein supplied as food. The average annual per capita consumption of fish is 67 kg per year and goes up to 75 kg among the fishing communities.[17]

2) Factors affecting fisheries in Cambodia

The catch seems to have been considerably reduced, especially that of the large-sized fish species. The quantity of medium-sized fish has not reduced very drastically and small-sized fish are still available in plenty. According to Thouk and Zalinge,[18] the challenges adversely affecting fisheries in the various regions are:

1) **Tonle Sap region and flood plains**: Shrinking flood plains due to lower Mekong flood levels, degradation and removal of flooded forests, increasing fishing pressure on flood plains and the Great Lake resources, infrastructure development in the Great Lake area, conflicts in and around fishing lots;

2) **Mekong Basin**: Planned dams on the Sesan and Srepok rivers blocking off spawning areas of migratory fish species and the planned Sambor dam on the main fish migration channel;

3) **Mekong-Bassac system:** Deforestation of flood plains in Takeo, Kandal and Prey Veng provinces.

Other problems include lack of inputs for aquaculture, lack of fish seed and feed, low levels of technology, arriving at optimal feed formulations, management of cages and lack of capital.

A recent review of the Mekong fisheries by the Mekong River Commission[20]shows that, for the countries covered by the Mekong River Commission, nearly 80% of the freshwater catch came from river fisheries, with reservoir fisheries and aquaculture contributing around 10% each. The fisheries make significant contributions to the economies of all four riparian countries. Records of fish catches over the same period are incomplete and inaccurate and therefore we cannot assess precisely the impact that ecological changes have had on fish populations.

The Department of Fisheries administers the 'Fiat-law' first brought out in 1987, and the function of the legislation includes regulation of the country's inland, marine and aquaculture fisheries resources. Fines can be imposed for certain violations. Currently, legislation relating to marine protection is poor and there is a possibility that the coastal environment will degrade rapidly, especially through intensive marine aquaculture development, if not protected by adequate laws.

The market for fish, especially freshwater fish, is favourable, as there is a high demand both in the internal as well as the external market. The overall trend predicts favourable exports.[21] The Department of Fisheries has highlighted the need for new and innovative measures to sustain greater consumption of marine species, the development of pond culture in inland areas and the rehabilitation and intensification of fish production from the Mekong and Bassac flood plains.

2.3 Natural Disasters

There is a need to look into transient food insecurity arising out of food shortages during natural calamities. Cambodia is considered as one of the most disaster-prone natural areas in Southeast Asia. It is especially vulnerable to water-related disasters, such as floods and

[14] Asian Development Bank "Future Solutions Now: The Tonle Sap Initiative", November 2004

[15] Royal Government of Cambodia Department of Fisheries "Aquaculture Review" Cambodia, February 2001.

[16] CDRI, "Cambodia's, Annual Economic Review- December 2004"

[17] World Resources Institute "Coastal and Marine Ecosystems - Cambodia Country Profile 2000" http://earthtrends.wri.org/text/coastal-marine/country-profiles.html

[18] Compendium on Environment Statistics, Cambodia, 2003

[20] Mekong River Commission www.mrc.mekong.org.

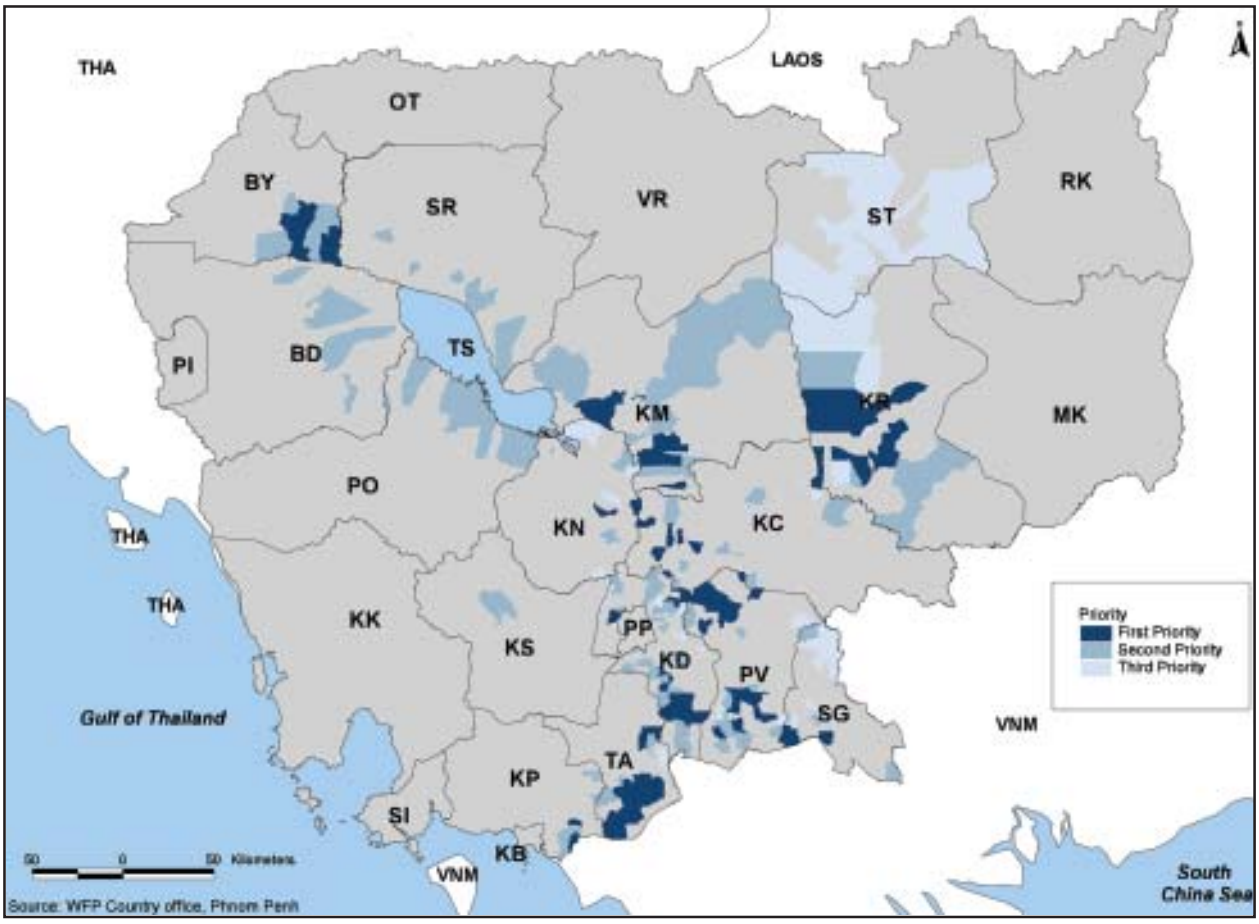
droughts. The country has been severely affected by droughts and floods in almost every two years for the past ten years.

1) Floods

People in Cambodia's central lowlands have lived with the pattern of seasonal flooding for many generations and have adapted their life-style to the rhythm of the river. The annual flood provides nutrient silts that sustain rice and fish production. Floods are considered beneficial and positive as long as they come at the right time and are not too strong. However, this is often not the case and Cambodia is prone to unexpected flooding of severe proportions. During these floods, the poorer sections of the population are exposed to extremely unhealthy conditions. They lack access to clean water, there is a shortage of food and they often have to sell off all or a part of their assets to meet their immediate needs and to repair their damaged houses.

Agriculture is particularly vulnerable to flooding. More than 20% of the rice producing area had been affected by floods since 1996. Floods also damage infrastructure, especially since many roads are unpaved. According to the World Bank SIMA database, only 16% of roads are paved in Cambodia. These roads lack culverts, bridges or other conduits for floodwaters to drain. Thus areas get cut off during the rainy season

Map 2.4- FLOOD-PRONE COMMUNES



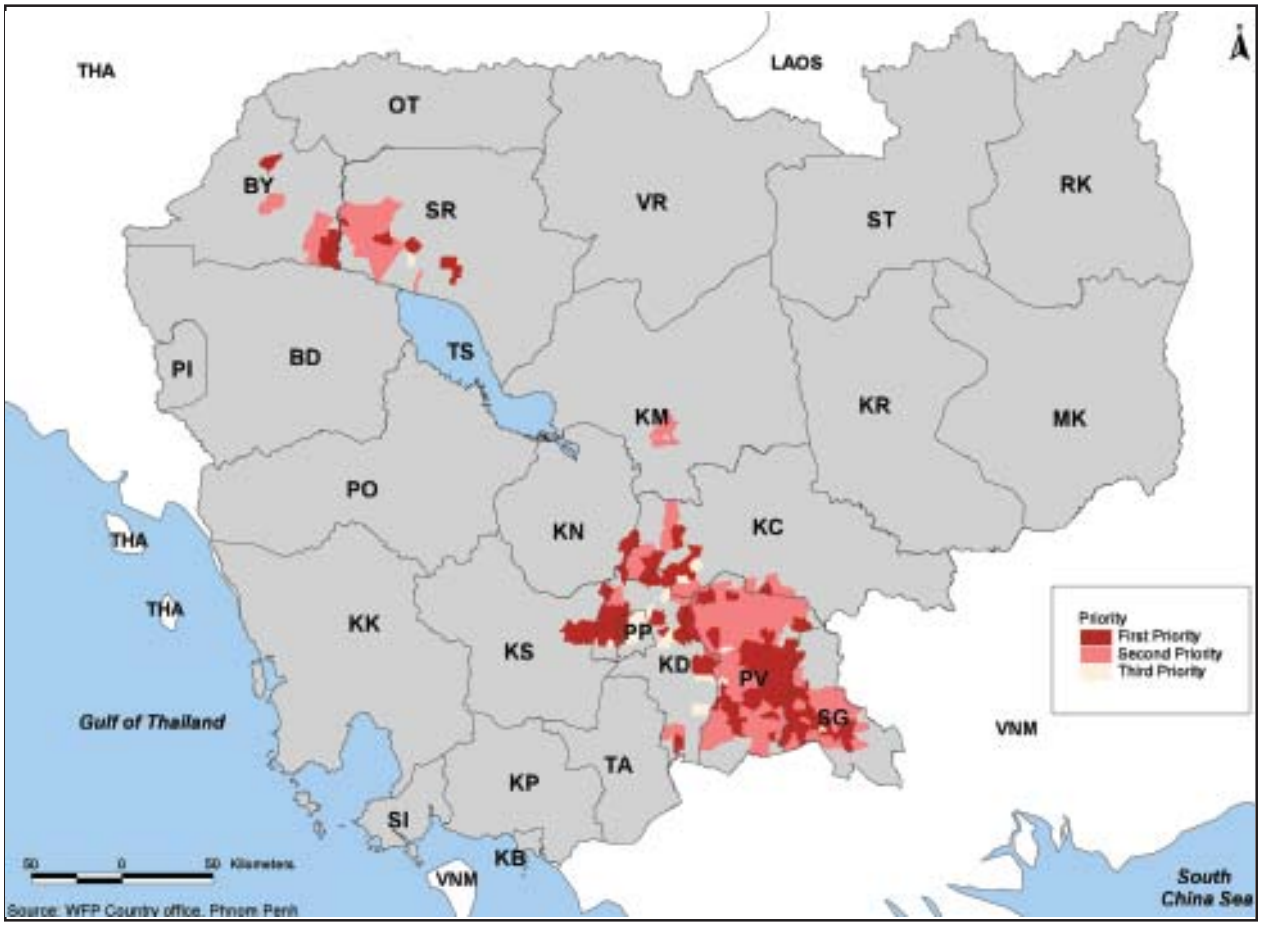
[21] Royal Government of Cambodia Department of Fisheries "Aquaculture Review" Cambodia, February 2001.

making it even more difficult for food supplies to reach the needy.

During the dry season, the Mekong River flows from the north to the south and finally empties into the South China Sea in Vietnam. During the wet season, however, the Mekong waters partly reverse their flow, and flow through the Tonle Sap River into the Tonle Sap Lake, which increases in width. It is the people living in this area who are most affected by floods. There are two distinct flood patterns in Cambodia – flash floods and central area floods. Flash floods occur as a result of heavy rains in the upstream areas of the Mekong River in Myanmar, Lao PDR or Thailand. The affected provinces are Stung Treng, Kratie, Kampong Cham, Kandal, Phnom Penh, Prey Veng, Svay Rieng and Takeo, i.e. provinces located along the Mekong River. The second type of floods, central area floods, results from run off from the Mekong River and heavy rains in Cambodia, especially around the Tonle Sap Lake. Areas affected by central area floods are Kampong Cham, Kandal, Prey Veng, Svay Rieng and Takeo.[22] (Map 2.4)

It is difficult to assess the occurrence of historically severe floods for the period before 1980, since most of the data and information existing during that time was lost during the Khmer Rouge period. From 1990 to the present, flood-related disasters were recorded in 1991, 1994, 1996, 1999, 2000, 2001 and 2002. A study by the World Bank calculates that an average of about 100 people will be killed each year by

Map 2.5- DROUGHT-PRONE COMMUNES



flooding and that these floods will result in annual financial loss in the range of about 100 to 170 million US dollars. Severe floods hit the country in 1996, 2000 and 2001. The flood in 2000 was the worst in 70 years. More than 3,448,000 people were affected. In 2001, considered a "normal" year of flooding, 190,000 families were displaced and more than 400,000 adversely affected. The late arrival of rains in the early wet season, and the flash flooding of the Mekong River later in 2002, added to the worsened situation. [23] The floods in 1991 and 1999 were followed by outbreaks of severe malaria and diarrhoeal diseases.

By combining satellite images of flooding, crop assessment data and rice production at the commune level (as a proxy for food security), it is possible to identify the level of flood vulnerability for each province. The provinces of Kratie, Takeo and Banteay Meanchey were identified as being high vulnerability areas. The people in these areas were most likely to face floods and suffer from food shortages once floods hit. These areas suffered floods in 1996, 2000 and 2001, and they had food shortages in 1996 and 2000.

Table 2.11 - Cambodian Natural Disasters, 1991-2002

Year of Occurance	Disaster Event	No. of Persons Affected	Location
1991	Flood	650000	Kampong Cham, Prey Veng, Kampot, Kompong Speu Takeo, Kandal Provinces
1994	Flood	29000	Battambang, Takeo Kampong Cham, Kandal Kampong Speu, Phnom Penh
1995	Famine, Drought	2500000	--
1996	Famine, Drought	2500000	Prey Veng, Kampong Speu, Kampong Chhnang, Takeo Provinces
1996	Flood	1300000	Kratie, Phnom Penh, Ratanak Kiri, Stung Treng Kampong Cham, Kandal, Prey Veng Provinces
1998	Famine, Crop Failure	900000	N.A. on the source
1999	Flood	527904	Sihanoukville, Koh Kong, Kampot
1999	Flood	106670	Takeo, Kandal, Kampong Speu, Phnom Penh Municipality, Pursat
1999	Epidemic, Diarrhoeal/ Enteric Diseases	1254	Ratanak Kiri Province
2000	Flood	3448000	Stung Treng, Kratie, Koh Kong, Kampong Cham Pursat, Kampong Thom, Takeo, Siemreap
2001	Flood	1669182	Stung Treng, Kratie, Kampong Cham Provinces
2001	Drought	300000	--

Note: Not all affected locations are included in this table.
Source: CRED, EM-DAT: OFDA/CRED, Disaster Database, http://www.cred.be/emdat/intro.htm.

[22] National Committee for Disaster Management, Royal Government of Cambodia and World Food Programme "Mapping Vulnerability to Natural Disasters in Cambodia".

Food shortages during the flood periods were found to be a major problem. Many households had to approach the village headman who would ration out some rice or other basic food to them. This ration often did not last for more than a week. The coping strategy of reducing consumption was viable only for short periods of time and would otherwise pose a threat to individual and family health. Another coping strategy adopted was harvesting of common property resources during and after the disaster. The lack of proper management of these resources and restrictions of access have led to a decline in the availability of these resources. Rural households also depend heavily on private moneylenders for credit for food and medicines. Indebtedness becomes inevitable during and after natural disasters. The debt burden over years lead to higher levels of vulnerability, loss of assets and land. Floods in Cambodia are such that they cannot be prevented or resisted, but rather have to be largely coped with.

2) Droughts

Representatives of the Ministry of Water Resources and Meteorology consider droughts to be the most serious type of disaster in Cambodia because it affects a larger geographical area and more people than floods. Despite this, more attention is given to floods. The year 1995 and 1996 witnessed a drought situation, with almost 2.5 million people being affected. In 1998, there was a drought leading to crop failure. The year 2001 was also a drought year and 300,000 people were affected in the provinces of Stung Treng, Kratie and Kampong Cham. The latest major drought, which took place in 2002, hit 8 provinces, with more than 2 million people, or 16% of the population affected. The cost of the drought was estimated to be more than 38 million US dollars.

The drought-prone areas have been identified using three broad categories: drought-affected area (arrived at by analysing long-term average precipitation and NDVI[24]), rice dependency (using crop assessment data) and the food security situation (using rice production at the commune level). Svay Rieng, Kandal, Prey Veng and Banteay Meanchey were identified as first priority areas, i.e. these areas were highly likely to face drought and, though over 80% of the population is actively engaged in rice farming, they fail to produce sufficient rice for their own consumption when affected by droughts. [25] These four provinces also appear to have high levels of instability in rice and maize production. Kandal is also a deficit province for rice production as noted in the previous discussion. (Table 2.11) (Map 2.5).

3) Disaster Management

Given that the country is prone to disaster, Cambodia has needed to set up an effective response mechanism to meet needs during and after a disaster. The frequency of these disasters, which is expected to continue into the future, requires improved response and mitigation measures. These measures should seek to increase the resilience to such natural disasters. The National Committee for Disaster Management (NCDM) was created to coordinate efforts in disaster management. MoWRAM and the Mekong River Commission (MRC) are working towards developing an early warning system. There are also relief and disaster management programmes led by other agencies, such as the Asian Development Bank, the World Bank, the World Food Programme, and the United Nations Development Programme. Noticeably, most of these strategies are directed towards floods even though it is droughts that affect a larger proportion of the population.

[23] The World Bank "Natural Disaster Risk Management in Cambodia: Reducing Vulnerability" A Study Report, March 2004.

[24] Normalise Difference Vegetation Index: NDVI is calculated from the visible and near-infrared light reflected by vegetation. Very low values of NDVI (0.1 and below) correspond to barren areas of rock, sand, or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values indicate temperate and tropical rainforests (0.6 to 0.8)

[25] National Committee for Disaster Management, Royal Government of Cambodia and World Food Programme "Mapping Vulnerability to Natural Disasters in Cambodia".

CHAPTER 2

Section B

Natural Resource Endowments and Production Prospects

2.4 Natural Resource Endowments

There are two aspects to food availability: present security and future sustenance. It is important to produce enough food at present without damaging the environment and the natural resources base required for future food production. In this section, we shall study the natural resource base of Cambodia to determine the country's agricultural prospects. Reliable data on natural resources are not available for the recent period. Most of the data pertains to 1998. There are reasons to believe that since 1998 there has been a considerable degradation in the natural resources of Cambodia. This is partly due to over exploitation of some resources, such as forests. It is also due to the impact of the activities of neighbouring countries in the upper Mekong region, which are responsible for variations in the quantity and quality of water, with detrimental repercussions on the wetlands of Cambodia. Over exploitation of resources, such as inland and marine fisheries, forests, as well as encroachment into water bodies, have also been observed. Based on studies undertaken by other agencies, this section attempts to summarize the extent of natural resource endowments. The section also attempts to identify the provinces that could be earmarked for productivity enhancements based on existing natural resources, such as soil types and rice ecosystems, water availability, temperature, rainfall, drought and flood proneness. Land-use maps, soil maps and rice ecosystem maps have been used for this purpose.

The Topography

The physical geography of Cambodia shows gently rolling alluvial plains forming the centre of the country. The Mekong River drains these plains. Cambodia is spanned by mountains on three sides and by a narrow coastal strip in the southwest. The Dangrek Mountain range form the frontier with Thailand in the northwest. The Cardamom Mountains and the Elephant Range spread across the west. Stretching along the central part of Cambodia are the alluvial plains.

The principal inland water bodies are the Mekong River, the Tonle Sap Lake, and the Tonle-Bassac River, which form about 2% of the total land area of Cambodia. The great Mekong River stretches across the country in a north-south orientation and forms a huge delta in the southeast region of the country. The Tonle Sap Lake lies at the heartland of the country in a northwest to southeast orientation and connects with the Mekong at Phnom Penh. The Tonle Bassac River flows southwards from this point to the delta region. Together they form a network of river channels and river basins that crisscross the entire lowlands.

2.4.1 Land

1) *Pattern of Land Use*

A study of the land use pattern provides an indication of the balance between natural resources and their exploitation levels. Reliable time series data are not available to systematically study changes in the land use pattern. Data are available from two sources. The Food

and Agriculture Organization (FAO) has provided data on the land use pattern up to 1994. The same data was repeated from 1994 up to 2004. Hence, we presumed that data was not available after 1994. The International Rice Research Institute (IRRI) has prepared a detailed land use map for 1997 with the help of the Australian Agency for International Development (AusAID). A digital copy of the map with data was made available by the Cambodian Rice Research Institute. This map provides complete data on the total geographical area of the country and is a more reliable source for 1997. However, the classification given by FAO is different from that of IRRI. The major advantage of the IRRI map is that the total geographical area can be divided exactly into the classifications given both at the national and provincial level. The area data of the IRRI map is also more accurate although the data is only for one year.

2) Trends in the pattern of land use

The FAO website has given data from 1961 to 1994 on land use in Cambodia. Land use for five non-overlapping categories has been finally derived from the data. They are: 1) Arable Land (2) Permanent Crops (3) Permanent Pastures (4) Forests and Woodlands and (5) Other Lands.

According to the FAO data, forest cover has come down from 13.2 million hectares in 1961 to 12.2 million hectares in 1994. The arable land and permanent pasture area increased from 3.5 million hectares in 1961 to 5.5 million hectares in 1994. There has been a steep decline in the land under the 'Other Land' category. There seems to have been a conversion of forest area and other unused land into non-forest area, such as cropped area, shrub lands, grasslands, etc. (Table 2.12)

In 1994, the land use pattern showed 67.4% of the total area under forests. It is not clear how much of this area was under open forest and how much was under dense forest, with a 40% canopy cover. About 20.4% of the geographical area was arable land used for seasonal crop production, 8.3% under pastures and 2.5% constituted water bodies. About 0.58% is under permanent plantation crops and about 0.81% was the remaining nondescript category (Table 2.13) (Fig. 1).

As per the FAO, the flooded forests covered 615,000 hectares in 1961. They had declined to 362,000 hectares in 1991 and to 239,000 hectares in 2004. Thus, there has been a reduction of flooded forests by about 62%. People have cleared most of the flooded forests to cultivate paddy. This may have increased rice production, but leads to environmental threats to water bodies and wetlands.

Table 2.13 - Cambodia Land Use Data, 1994

1	% of Land Area to Total Area	97.50
2	% of Agri. Area to Total Area	29.30
3	% of Arable & Permanent Crops to Total Area	21.02
4	% of Arable Land to Total Area	20.44
5	% of Permanent Crops to Total Area	0.58
6	% of Permanent Pasture to Total Area	8.29
7	% of Forests and Woodland to Total Area	67.39
8	% of All Other Land to Total Area	0.81
9	% of Non Arable & Non Permanent	76.49

Source: Faostat Citation

3) Land Use Pattern as per IRRI in 1997

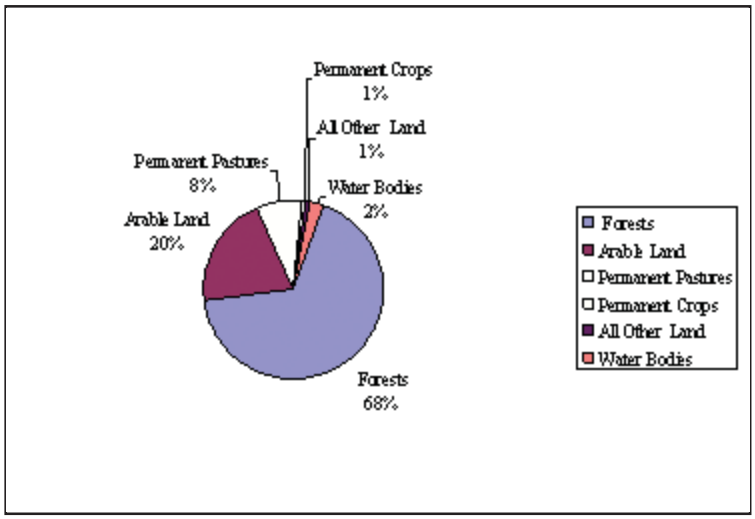
The actual areas have been calculated from the digital map provided by the Cambodian Rice Research Institute. The total land area in Cambodia is about 18,123,565 hectares, including the Tonle Sap Lake. The Tonle Sap water body consists of about 1.4% of the total land area. Land has been classified into eight categories as forests, agriculture, mangrove, plantations, grass, swamps, and blank area (probably denoting water bodies) and "mare" lands (probably representing non-use area). Forests formed about 62.57% of the total land area of Cambodia in 1997. Agricultural land, consisting of rice and upland crops, forms about 20.4% of the total land area. Plantations occupied around

Table 2.12 - Cambodia Land Use Data (1000 Ha), 1961-2002

Years	Total Area	Land Area	Agri. Area	Arable & Permanent	Arable Land	Permanent Crops	Permanent Pasture	Forests and Woodland	All Other Land	NonArable & Non Pernament
1961	18104	17652	3518	2938	2838	100	580	13285	849	14714
1962	18104	17652	3533	2953	2850	103	580	13280	839	14699
1963	18104	17652	3542	2962	2850	112	580	13270	840	14690
1964	18104	17652	3595	3015	2900	115	580	13260	797	14637
1965	18104	17652	3627	3047	2900	147	580	13250	775	14605
1966	18104	17652	3627	3047	2900	147	580	13240	785	14605
1967	18104	17652	3629	3049	2902	147	580	13231	792	14603
1968	18104	17652	3577	2997	2850	147	580	13230	845	14655
1969	18104	17652	3477	2897	2750	147	580	13230	945	14755
1970	18104	17652	3419	2839	2693	146	580	13210	1023	14813
1971	18104	17652	2450	1870	1800	70	580	13200	2002	15782
1972	18104	17652	2450	1870	1800	70	580	13200	2002	15782
1973	18104	17652	2450	1870	1800	70	580	13200	2002	15782
1974	18104	17652	2500	1920	1850	70	580	13190	1962	15732
1975	18104	17652	2500	1920	1850	70	580	13190	1962	15732
1976	18104	17652	2550	1970	1900	70	580	13190	1912	15682
1977	18104	17652	2550	1970	1900	70	580	13180	1922	15682
1978	18104	17652	2600	2020	1950	70	580	13180	1872	15632
1979	18104	17652	2600	2020	1950	70	580	13170	1882	15632
1980	18104	17652	2650	2070	2000	70	580	13160	1842	15582
1981	18104	17652	2650	2070	2000	70	580	13160	1842	15582
1982	18104	17652	2680	2100	2030	70	580	13160	1812	15552
1983	18104	17652	2690	2110	2040	70	580	13160	1802	15542
1984	18104	17652	2691	2110	2040	70	581	13155	1806	15542
1985	18104	17652	3170	2370	2300	70	800	13000	1482	15282
1986	18104	17652	3680	2680	2600	80	1000	12800	1172	14972
1987	18104	17652	4280	3080	3000	80	1200	12600	772	14572
1988	18104	17652	4930	3530	3450	80	1400	12400	322	14122
1989	18104	17652	5285	3785	3695	90	1500	12143	224	13867
1990	18104	17652	5349	3795	3695	100	1554	12170	133	13857
1991	18104	17652	5300	3800	3700	100	1500	12200	152	13852
1992	18104	17652	5300	3800	3700	100	1500	12200	152	13852
1993	18104	17652	5319	3819	3716	103	1500	12200	133	13833
1994	18104	17652	5305	3805	3700	105	1500	12200	147	13847
1995	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845
1996	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845
1997	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845
1998	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845
1999	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845
2000	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845
2001	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845
2002	18104	17652	5307	3807	3700	107	1500	N/A	N/A	13845

Source: Foastat Citation; N/A: Not Available

Figure 2.1 - Land Use Pattern of Cambodia – 1994 (FAO)



3.6%; water-bodies consist of about 2.7% (Fig.2.2). Thus, there is some discrepancy between the FAO data of 1994 and IRRI data of 1997 (Table 2.14).

The IRRI map also gives us information about the mangroves and wetlands. Mangroves cover approximately 49,561 hectares in the country. They are an important environmental resource as they provide breeding grounds for fish, which is a source of livelihoods for people. The swamp area covers around 897,942 hectares in Cambodia. This also includes flooded forests that are a beneficial ecosystem. Plantations form 654,873 hectares of the total land area. They include pine forests, shrubs, thickets and rubber plantations (Map 2.6)[26]

Table 2.14 - Cambodia Land Use Pattern, 1997

No	Land	Area in Ha.	% to Total Land Area
1	Forest	11339220.55	62.57
2	Agriculture	3691602.33	20.37
3	Plantations	654872.96	3.61
4	Grass	960312.15	5.30
5	Swamp	897942.60	4.95
6	Water Area	479984.86	2.65
7	Mare	50068.78	0.28
8	Mangrove	49560.68	0.27
9	Total Land Area	18123564.91	

Source: International Rice Research Institute - 1997

4) Provincial-level Land Use Pattern

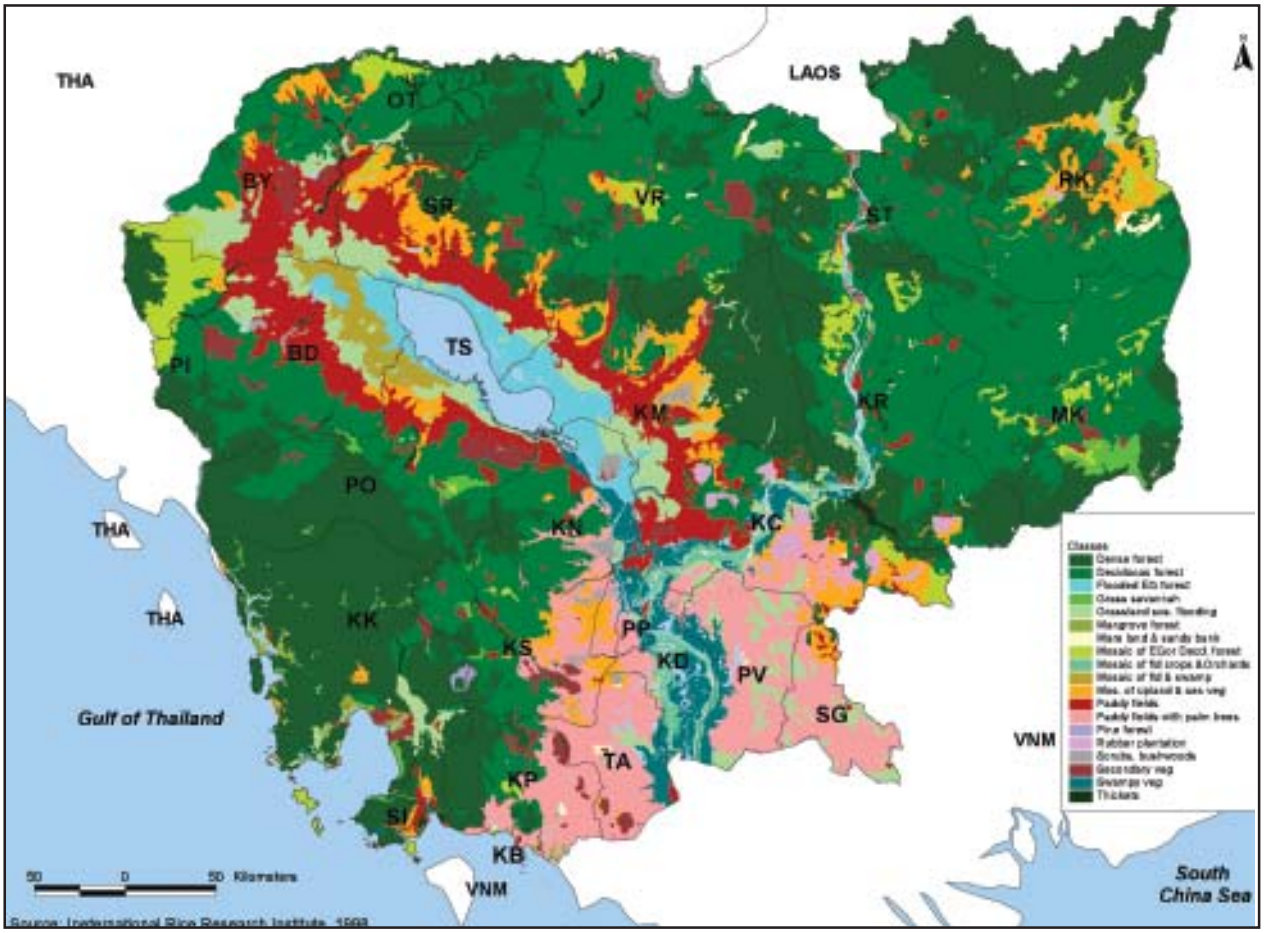
The land use pattern for the provinces has been assessed from data presented by the Ministry of Agriculture, Forestry and Fisheries.[27] Much of the land in the southern provinces of Kampong Cham, Kandal, Takeo, and Prey Veng is used for agriculture. More than 50% of the land area is under cultivation in all these provinces, except Kampong Cham, which has 48% of its land area under cultivation. Rice has been intensely cultivated in these lowland provinces. They are a part of the delta of the lower Mekong basin, before the river flows into the southern part of Vietnam (Table 2.15).

Characteristically, these cultivated areas are also areas of low forest cover, forming less than 10% of land use, except in Kampong Cham where it is 27%. The major forested areas are the northeastern provinces of Preah Vihear, Stung Treng, and Mondul Kiri, as well

[26] International Rice Research Institute (IRRI), 1998.

[27] Royal Government of Cambodia, Ministry of Agriculture Forestry and Fisheries, http://www.maff.gov.kh/paffd.html.

Map 2.6 LAND USE



as the western province of Pailin, where forests form more than 90% of the land area. The provinces of Koh Kong, Kratie, Ratanak Kiri, Sihanoukville and Oddar Meanchey have 70-80% of land area under forests. The central province of Pursat also shows a high forest cover. Phnom Penh and Kandal have a comparatively larger area under water bodies. This is because of the presence of the Mekong River and the Tonle Bassac River. None of the provinces include the Tonle Sap Lake area. It is given separately (Table 2.16).

2.4.2 Soils

About 11 major soil types have been identified in the rice ecosystems in Cambodia (adapted from White et al. 1997). Cambodian rice cultivation ecosystems and soil types have evolved in response to the diverse conditions of geomorphology, topography and hydrology. Three physiographic regions subdivide the rice areas.

[28] Alluviation is the washing of sediments or erosion from the hills by rivers through gullies and ravines. Colluviation is the movement of weathered and loose soil down slopes through gravitational action. These deposited sediments in the course of time form gently undulating terraces.

Table 2.15 - Provincial Land Use Pattern

No		Province/ Municipality	% of Total Geographic Area (TGA)	% of Human Settlement to TGA	% of Agricultural Land area to TGA	% of Forest Area to TGA	% of Water Bodies to TGA	% of Non-use Area to TGA
1	p	Banteay Meanchey	3.69	1.87	32.35	51.39	12.11	2.27
2	p	Battambang	6.42	3.63	35.73	38.22	12.55	6.22
3	p	Kampong Cham	5.41	0.51	48.32	27.06	2.28	21.84
4	p	Kampong Chhnang	3.05	4.21	32.77	45.80	11.85	5.38
5	p	Kampong Speu	3.88	4.56	14.99	48.33	29.25	2.87
6	p	Kampong Thom	8.32	7.69	12.01	69.51	18.49	10.80
7	p	Kampot	2.69	--	27.21	56.39	--	--
8	p	Kandal	1.96	7.84	58.23	8.64	4.35	25.29
9	p	Koh Kong	6.16	--	1.99	44.00	50.00	--
10	p	Kratie	6.13	--	8.00	83.50	8.00	0.50
11	m	Kep	0.21	11.97	9.65	19.15	59.23	--
12	m	Pailin	0.61	14.39	30.06	45.61	9.93	--
13	m	Sihanoukville	0.48	3.43	26.12	47.05	13.87	9.53
14	p	Mondul Kiri	8.11	15.33	--	76.43	--	8.23
15	p	Oddar Meanchey	3.73	2.86	8.97	78.30	1.55	8.30
16	m	Phnom Penh	0.21	70.46	21.33	--	7.88	0.32
17	p	Pursat	7.01	1.50	8.90	67.48	9.82	12.30
18	p	Preah Vihear	8.29	1.63	2.58	70.00	2.97	22.81
19	p	Prey Veng	2.70	9.12	63.49	3.99	22.18	1.24
20	p	Ratanak Kiri	--	--	--	--	--	--
21	p	Siemreap	5.65	10.73	19.26	54.45	9.93	6.31
22	p	Stung Treng	6.13	9.30	1.71	83.66	4.12	1.19
23	p	Svay Rieng	1.64	5.50	1.84	67.45	13.81	2.44
24	p	Takeo	1.97	22.81	68.49	4.77	3.93	--
		Total	94.43	5.57	18.00	57.27	11.69	8.10

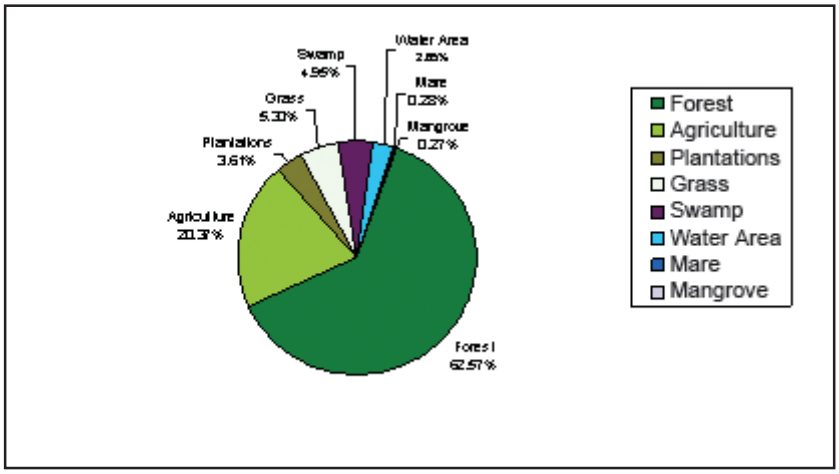
Source: Ministry of Agriculture, Forestry and Fisheries, Cambodia, www.maff.gov.kh/provinces/... Accessed on 11 April 2005.
Note: The reference year was not known.

Table 2.16 - Land Use Pattern, 1997

No		Province/ Municipality	% of Forest Area to Total Land Area	% of Agriculture Area Total Land Area	% of Plantation Area to Total Land Area	% of Water Area to Total Land Area
1	p	Banteay Meanchey	35.98	35.67	6.38	0.59
2	p	Battambang	51.04	20.51	4.38	0.36
3	p	Kampong Cham	27.78	42.65	10.28	3.15
4	p	Kampong Chhnang	47.73	18.03	5.38	3.25
5	p	Kampong Speu	60.60	30.91	7.23	0.18
6	p	Kampong Thom	46.48	31.12	2.80	1.00
7	p	Kampot	52.11	39.61	6.08	0.47
8	p	Kandal	0.00	45.46	1.24	16.99
9	p	Koh Kong	86.04	1.57	2.60	0.00
10	p	Kratie	86.71	4.82	2.08	2.68
11	m	Kep	12.56	68.10	8.83	-
12	m	Pailin	98.69	0.00	1.31	-
13	m	Sihanoukville	72.24	18.79	3.03	0.19
14	p	Mondul Kiri	94.01	0.30	1.40	0.01
15	p	Oddar Meanchey	81.05	12.04	4.50	0.08
16	m	Phnom Penh	0.00	55.35	0.00	13.44
17	p	Pursat	71.96	12.17	4.68	0.33
18	p	Preah Vihear	90.17	2.86	5.34	-
19	p	Prey Veng	0.30	65.52	0.58	2.75
20	p	Ratanak Kiri	82.42	12.54	1.71	-
21	p	Siemreap	47.53	35.64	1.49	0.66
22	p	Stung Treng	93.58	2.45	1.89	1.90
23	p	Svay Rieng	1.38	79.25	0.00	0.27
24	p	Takeo	0.33	74.03	6.08	4.30
25		Tonle Sap	0.00	0.06	0.18	-
		Total	62.57	20.37	3.61	2.65

Source: International Rice Research Institute - 1997

Figure 2.2 - Land Use Pattern of Cambodia – 1997 (IRRI)



a) Traditional rice-growing areas:

Soils developed from old alluvial and/or colluvial plains.[28]They are located in almost all the rice-growing areas and have moderate to low fertilities, as much of the nutrients and organic matter have either leached out or have been swept away by erosion.

b) Upland soils and soils of the foothills:

These soils are derived from both sandstone and shale, which formed the mountains surrounding the country during relatively recent geological activities. Soils formed in this manner are relatively young and fertile. Most of the upland soils and the soils in the foothills are made this way.

c) Soils of the flood plains:

Soils developed on active floodplains[29] of rivers and lakes. There are three types of flood plains: a) meandering flood plains formed from rivers that migrate laterally and thus keep changing their course; for example, the Mekong River, b) extensive floodplains formed in the lower deltaic regions of the Mekong and Tonle Bassac rivers and c) lacustrine floodplains, formed in the areas surrounding the Great Lake that are repeatedly flooded. These soils are very fertile and are periodically replenished by the alluvial deposits carried by the floodwaters (Table 2.17) (Map 2.7).[30]

2.4.3 Forest Cover

Forests perform a multitude of ecological functions that help to maintain the stability and resilience of the earth's major ecosystems. These include maintaining the hydrological balance of watersheds, stabilising topography, preserving topsoil, maintaining soil fertility, preserving the local climate and mitigating climate change by sequestering carbon. Riparian forests stabilize riverbanks, regulate water flow to the sea and estuaries, and improve oxygen levels in the rivers. Forests are also closely linked to traditional agro-ecosystems and the cultures of the people who inhabit them.

There are significant and valuable economic benefits from forests. Timber has been a major source of revenue in terms of foreign exchange to the government. Cambodia also uses a lot of fuelwood for energy. Ninety-two per cent of the population in

29 Floodplains are "extensive level areas beside a river formed of deposits of sediment brought downstream and spread by the river during time of flood." Active floodplains refer to the areas that continue to receive alluvial deposits.

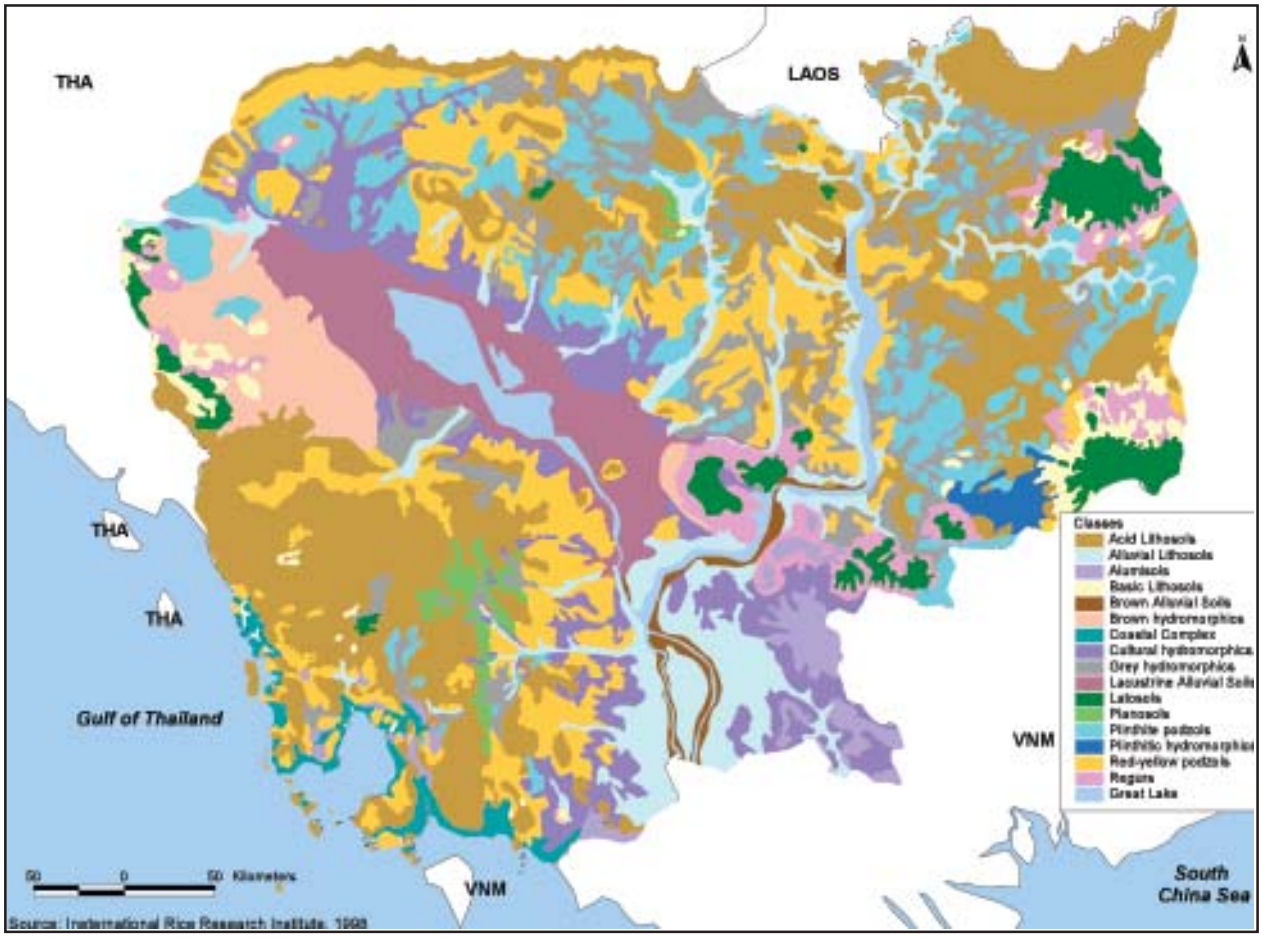
30 White, P.F., Oberthur, T. and Sovuthy Pheav "The Soils Used for Rice Production in Cambodia", Cambodia-IRRI-AusAID, 1997.

Table 2.17 Characteristics of Major Soil Types in the Rice Cultivation Areas

Soil	Prey Khmer	Prateah Lang	Labans-iek	Orung	Krakor	Bakan	Kbal Po	Kein Svey	Toul Samroung	Koktrap	Kompong Siem
Texture	Sandy	Sandy Over Loam or Clay	Clayey	Loamy/Clayey-Over Sand	Loam/ Clay Over Sand/Loam /Clay	Loam/Clay Over Loam/Clay	Clay Over Clay	Loam/Clay Over Laom/Clay	Loam/Clay Over Loam/Clay	Black Soil Over Clay	Black Clay Over Clay Stones/Boulders
Occurrence	Old Alluvial Colluvial	Old Alluvial Colluvial	Sides of Hills, Mountains	Meandering Floodplains	Floodplains that remain inundated	Old Alluvial Colluvial Phreatic	Active Lake, River Floodplains	River Levees and Backslopes of Meander Floodplains	Old Alluvial Colluvial & Weathered	Old Alluvium	Foothills
Province	Pursat; K. Chhnang; K.Speu; Siemreap	All Rice Growing Areas	Mondul-Kiri; Ratanak-Kiri; K.Chan; Kratie	K.Chang; Pursat; Siemreap	River Basins Deltas; All provinces	All Rice Growing Areas	Kandal; Takeo Prey Veng & Around Tonle Lake	Kandal; Phnom Penh; Kampong Speu; Prey Veng; Kampong Cham; Kampong Thom; Kratie; Stung Treng	Battambang; K.Speu; Pursat K.Thom; K.Cham	Prey Veng; Svay Rieng; Kandal; Takeo	K. Cham; Kratie; Ratanak Kiri; Battambang
Rice Area	10-12%	25-30%	<1%	1-2%	15% Deep Water Rice	0-15%	15%	15%	7-10%	5%	2%
Suitability for Rice	Difficult for rice; low yield potential; not suitable for irrigation; low-fertility; nutrient leaches out; organic matter; low acidic, PH; favorable for rice when flooded; low water holding capacity; prone to droughts; deep root rice needed.	Difficult for rice; low yield potential; not suitable for irrigation; low-fertility; nutrient leaches out; organic matter; low sulphur toxicity acidic, PH; favorable for rice when flooded; low water holding capacity; prone to droughts; non-rice is a problem.	Upland rice; mostly good for upland rice; moderate fertility responds well to fertiliser & irrigation; organic matter; high mild acidic/alkaline; good water hold capacity.	Difficult for rice; low-yield potential; not suitable for irrigation; low-yield potential; benefit from irrigation; low-fertility; nutrient leaches out; organic matter; low mod./well drained; good water holding cap.; prone to water-logging.	Rice cultivated in wet seasons and receding; fully/rartly irrigated; good potential; deep cracks on drying responds to fertility irrigation; good fertility.	Well suited responds well to improved management; suitable for irrigation; mod. fertility; organic matter; low surface sets hard when dry; good for transplanted rice; poor drainage; prone to water-logging.	Suitable for high potential responds to management; suitable for irrigation; good fertility; mod./ high organic matter; acid-neutral PH; good water holding capacity; cracks when dry; prone to water-logging.	Suitable for rice, vegetables & fruits; high potential responds to improved management and ferti. requires irrigation; mod. fertility; mod. organic matter; acid-neutral PH; good drainage in loam.	Well suited & mod-high yield pot respond well to management; suited for irri.; low fert.; low/ mod. org. matter; acid-neutral PH; good drainage; deep cracks; prone to water-logging.	Well suited & mod-high yield pot respond well to management; suited for irri.; low fert.; low/ mod. organic matter; neutral PH; buffered Fe; toxicity; good water holding capacity; soil sets when dry; water-logging.	Well suited for rice; lowland wet rice; fertile respond to ferti / management; suited for irrigation; org. matter; acid-alk PH; Fe; toxicity; good water holding capacity; soils set when dry; high initial drainage.

Source: White, P.F., T. Oberthur and Pheav Sovuthy, 1997. The soils used for rice production in Cambodia, Cambodia-IRRI-AusAID, IRRI

Map 2.7- SOIL CLASSIFICATION



Cambodia is dependent on fuelwood as the major source of energy. The dependence on fuelwood in the country, peaked during the 1980s and early 1990s and has registered a decline ever since.

The Ministry of Agriculture, Forestry and Fisheries has provided information on forests. However, the reference year is not known. The current land use statistics suggest that forest cover is about 58% of the total geographic area of the country (Map No. 2.8). A large part of provinces, such as Pursat, Siemreap, Stung Treng and Pailin are covered with forests. Forests include deciduous forests, dense broad-leaved forests and mosaic or evergreen deciduous forest (Table 2.15 & 2.18 & 2.19).

Mangroves cover about 0.4% of the total forest cover. They are present along the 435 kms of coastline (Pruett et al. 2000)[31] and cover a total area of 851 sq km (Spalding et al. 1997)[32]. Flooded forests can also be seen along the Tonle Sap Lake. Along with mangroves they form what are called the "edaphic forests" (Narith 1997)[33].

[31]Pruett, L and J. Cimino, "Global Maritime Boundaries Database" (unpublished data), Viridian - MRJ Technology Solutions, Fairfax, Virginia 2000.

[32] Spalding, M.D., Blasco, F. and Field, C.D., eds. "World Mangrove Atlas" International Society for Mangrove Ecosystems (ISME), Okinawa, Japan, 1997.

[33]Narith, Hong, "Some Aspects of Forestry in Cambodia: Country Paper" Asia-Pacific Forestry Sector Outlook Study, FAO, Bangkok, 1997.

Forests are unevenly distributed in the country. The northern, northwestern and central parts of the country are better endowed with forests than the southern parts. Forests in the north and northwest parts of the country, which include the provinces of Oddar Meanchey, Preah Vihear, Banteay Meanchey and Battambang, are evergreen. Those that occur in the northeast in the provinces of Ratanak Kiri, Mondul Kiri are more deciduous forests. The provinces of Pursat, Kampong Thom and Kampong Chhnang come within the flood zone of the Tonle Sap-Mekong hydrological system. Forests in these parts are typically flood forests. The coastal provinces of Koh Kong and Kep are rich in coastal mangrove forests.

Table 2.19 - Forest Cover by Forest Type, 1997

No	Forest Type	Area (Ha)	% of Total Land Area
1	Swamp Mosaic	105464	0.60
2	Evergreen Closed	634869	3.60
3	Evergreen Disturbed	3323527	18.83
4	Evergreen Mosaic	135632	0.77
5	Semi-evergreen Closed	111842	0.63
6	Semi-evergreen Disturbed	1184689	6.71
7	Semi-evergreen Mosaic	97905	0.55
8	Deciduous	3777678	21.40
9	Deciduous Mosaic	274552	1.56
10	Regrowth	544777	3.09
11	Swamp Regrowth	23590	0.13
12	Swamp	222149	1.26
13	Mangrove	77259	0.44
14	Bamboo	21822	0.12
15	Total Land Area	17652000	

Source: FAO- 2002

Table 2.18 - Percentage of Cambodia's Forest Cover, 2004

No	Forest Types	Million (Ha)	%
1	Deciduous Forests	4.80	26.70
2	Forest Cover Estates	11.10	61.33
3	Evergreen Forests	3.70	20.50
4	Semi-evergreen Forests	1.50	8.04
5	Total Area	18.10	

Source: KoC, 2004

Statistics on the total number of communities that depend on the forests for their livelihoods are not available. However, what is certain is that with a predominantly rural population (more than 85% live in rural areas) and the distribution of forests in the country, the dependency on forests is large and varied. Indigenous forest communities understand the importance of forests and its various year-long produce for meeting their food and nutritional requirements. Non-wood forest products, such as vegetables, fruit, mushrooms, bamboo shoots and other insects and animals like crabs, gathered from accessible forests are a major source of food and income for these people. Forests, remains the main source of wood for the construction of houses.

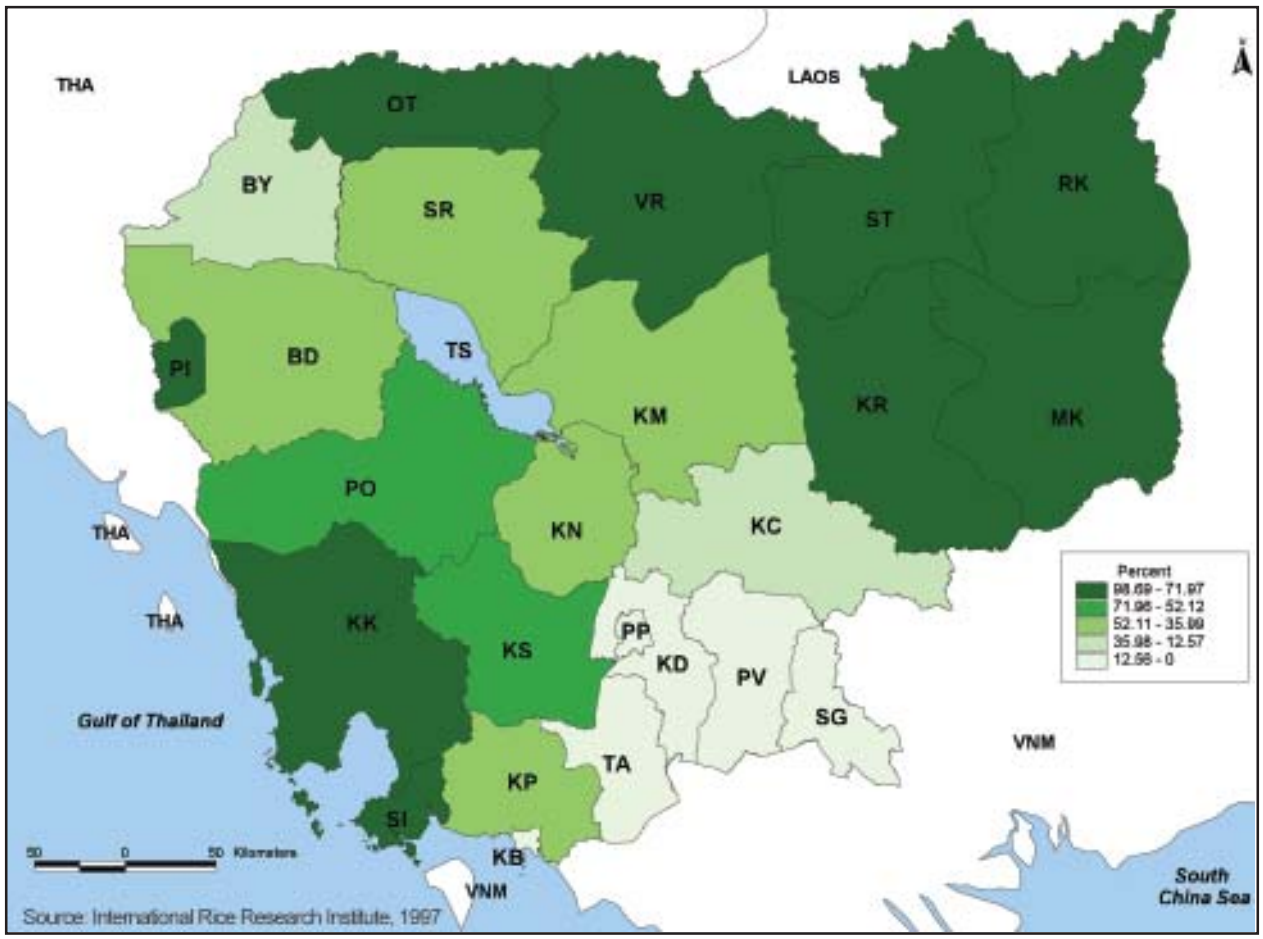
Change in Forest Cover

Statistics very clearly reveal a decline in the forest cover in the country (Fig.2. 3). Whereas, in the 1960s, forest cover was more than 70% of the total land area, this has drastically come down to about 58 % in 2004. The forest cover has reduced by over 16% since 1961 (Earth Trends Country Profiles 2003[34]), and declined drastically from the 1980s onwards. Flooded forests (apart from mangroves) and evergreen forests have registered the maximum decline of -3.0% and -1.5%, respectively, from 1973 to 1993. The edaphic forests are particularly threatened (Narith 1997)[35].

[34] World Resource Institute "Earth Trends: The Environment Information Portal", www.earthtrends.wri.org, 2003.

[35]Narith, Hong, "Some Aspects of Forestry in Cambodia: Country Paper" Asia-Pacific Forestry Sector Outlook Study, FAO, Bangkok, 1997.

Map 2.8 - PERCENTAGE OF FOREST COVER



The ultimate loss of fisheries and forestry results in severe loss to livelihoods and this occurs not just at the local level but at the national level as well. For instance, the state of fisheries in the Great Lake is threatened by the degradation of its habitat, the flooded forests. The flood regime of the Mekong River has declined by 15%; this coincides with the destruction of flooded forest cover, which has declined by 27% over 20 years from 1972/73 to 1992/93.[36]

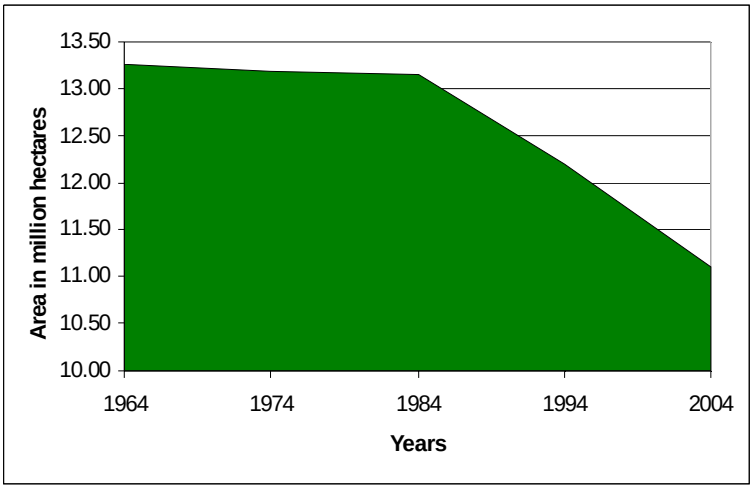
Logging for timber, shifting cultivation, wood harvesting for fuelwood and charcoal have been suggested as the major causes for the destruction of forestlands. National log production increased dramatically by 1993 (Fig. 2.4). Studies reveal that half of the fuelwood produced is extracted from forests and estimate that the total production peaked between 1980 and 1990 (Narith 1997)[37].

The political and social instability witnessed by the country over the past 30 years or more has been an important factor in the destruction of forests. Control over forests is linked to political issues. It has been stated

[36] These results have come from and cover inventories for the Tonle Sap (Mekong Secretariat 1994 referred in Cambodia NBSAP Add-On Project on 'Status of Fish Biodiversity in The Tonle Sap Great Lake, Cambodia' as it appeared in Cambodia's Biodiversity News Letter Vol.4, July – September, 2002).

[37] Narith, Hong, "Some Aspects of Forestry in Cambodia: Country Paper" Asia-Pacific Forestry Sector Outlook Study, FAO, Bangkok, 1997.

Figure 2.3 - Decadal change in forest cover (1964-2004)



that the allocation of access and user rights over forests was seen as a tool for political allegiance. About 3 million hectares of forests are currently leased out by the government as forest concessions to private interests. They face a threat of degradation unless effectively managed.

The consequences of forest destruction and degradation are well chronicled in the literature. However, due to the lack of data the full extent of ill effects cannot be stated in quantitative terms.

Mangroves of Cambodia

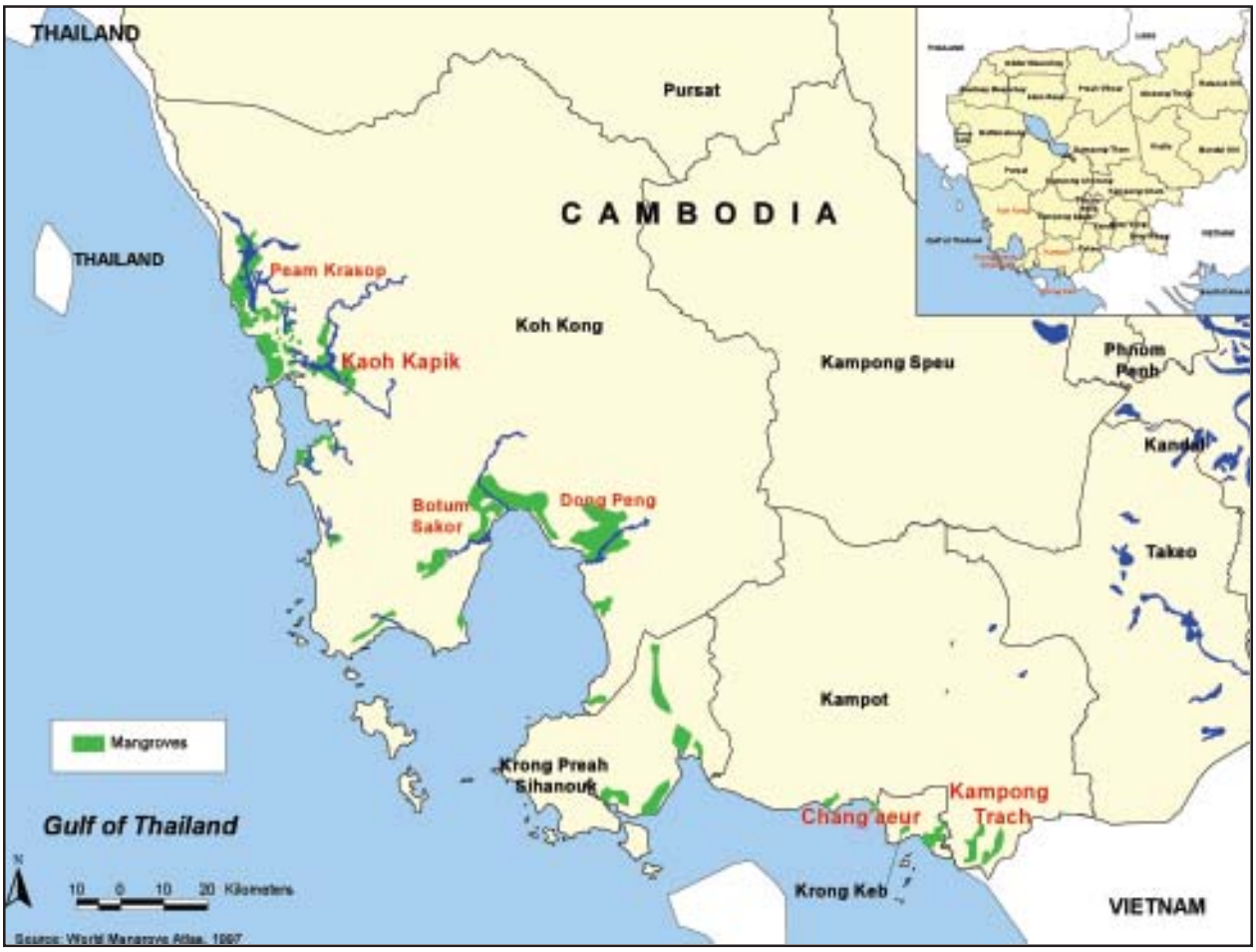
Cambodia has 435 km of coast running southeast to northwest facing the Gulf of Thailand. Here, the coastal areas are sparsely populated, with two to three times less population than the national average. Coral reefs and sea grass beds fringe the coastline of Cambodia and the coast contains rocky beds, sandy beaches and mudflats. There are 52 near and offshore islands, most of them undisturbed. They have vegetation with rocky and sandy shores and are surrounded by coral reefs and sea grasses. Along the coast of Cambodia, the estuarine intertidal mudflat and mangrove habitats support a distinctive fauna. Of particular importance are migratory populations of shorebirds.

Table 2.20 - Area of Mangrove Vegetation in the Coastal Districts

No	DISTRICT	AREA (Ha)
1	Botum Sakor	13640
2	Damnak Chang'aeur	1694
3	Kep	259
4	Kampong Bay	479
5	Kampong Trach	3047
6	Kampot	213
7	Koh Kong	8715
8	Kiri Sakor	2550
9	Mondul Seima	9580
10	Prey Nob	8811
11	Smach Meanchey	1739
12	Srae Ambel	12525
	Total	63255

Source: Based on World Mangrove Atlas, International Society for Mangrove Ecosystems, 1997
Edited by Mark Spalding, Francois Balsco and Colin Field

Map 2.9 - DISTRIBUTION OF MANGROVES ON THE COAST OF CAMBODIA



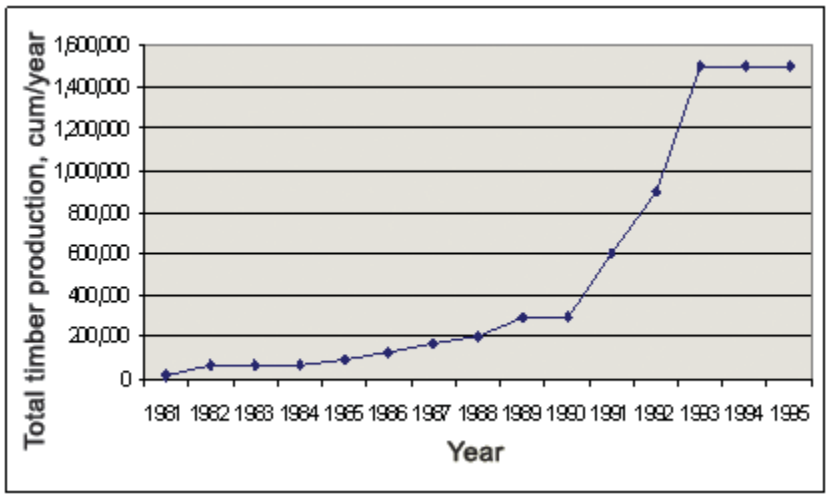
The Department of Forestry and Wildlife states that the total area of edaphic forests was 715,600 hectares in the 1993 survey, which was a reduction from 1,032,500 hectares in 1973. The edaphic forests include flooded, flooded secondary and mangrove forests. Mangrove areas changed from 94,000 hectares in 1973 to 85,000 hectares in 1993. The Japan Forest Technical Association's Land Cover Atlas, 1994, shows that the mangrove area was 16,498 hectares and rear mangrove forest was 17,655 hectares, accounting for a total mangrove forest cover of 34,153 hectares.

As per the FAO document (2001) there is an annual change of –1.5% of mangroves in all Asian countries from 1980 to 1990, and –1.3% from 1990 to 2000. For Cambodia, the annual change was of –1% from 1980 to 1990 and –1.5 % from 1990 to 2000. That was an area of 83,000 hectares of mangrove in 1980, 74,600 hectares in 1990 and 63,700 hectares in 2000. Next to China (-3.2% and – 4.7 %), Vietnam (-2.7% and –3.7%) and Yemen (-1.1% and –1.8%), Cambodia lost the largest area of mangroves during the last two decades. The Koh Kong province accounts

[38]Asian Development Bank (ADB). "Coastal and Marine Environmental Management for Ha Long Bay, Socialist Republic of Vietnam", Final Report prepared by EVS Environment Consultants Ltd. in the framework of the RETA 5522 project Coastal and Marine Environmental Management in the South China Sea, Asian Development Bank, Manila, August 1996.

[39]Spalding, M.D., Blasco, F. and Field, C.D., eds. "World Mangrove Atlas" International Society for Mangrove Ecosystems (ISME), Okinawa, Japan, 1997.

Figure 2.4 - Total timber production in cubic metres per year (1981-1995)



for 75 % of the total mangrove forest of Cambodia, and is followed by the provinces of Sihanoukville, Kampot and Kep, in the size of area under mangrove (ADB, 1996[38]) Table 2.20.

The International Society of Mangrove Environment has also mapped the extent of mangrove vegetation for Cambodia (World Mangrove Atlas, 1997[39]). The area was 60,100 hectares based on the interpretation of Landsat TM images of 1988/ 89, without ground truthing information (Map No.2.9).

2. 4. 4 Water Resources of Cambodia

Water is essential for ensuring food production. Safe drinking water is a prerequisite for healthy living. The main sources of water are rainfall, surface water and groundwater. The main water bodies of Cambodia are the Great Lake or the Tonle Sap, which lies in the heartland of the country and the Mekong River that runs in a northeast – south direction across the country. The Tonle Sap Lake and the Mekong River are connected by the Tonle Sap River. Cambodia's 435 km long coastline also provides it with 55,600 sq km of coastal water. The coastal provinces of Kep and Koh Kong are characterised by vast stretches of marine estuaries.

The total Internal Renewable Water Resources (IRWR)[40] in Cambodia have been estimated as 121 cubic kilometres between 1977 and 2001. Of this, 116 cubic kms (approximately 96%) was surface water originating within the country. In 2001, the annual per capita IRWR was 8,752 cubic metres, which is very high when compared to the Asian average of 3,241 cubic

Table 2.21 - Coefficient of Variation of Production and Rainfall, 1993-2003

	Coefficient of Variation
Rainfall	0.26
Rice	
Yield	2.63
Production	2.38
Area	3.43
Maize	
Yield	3.71
Production	2.35

Source: Ministry of Water Resources and Meteorology, http://www.faorap-apcascas.org/cambodia

[40] Internal Renewable Water Resources is defined to include the average annual flow of rivers and the recharge of groundwater generated from endogenous precipitation.

Table 2.22 - Average Rainfall in Selected Areas, 1994-2002 (11 months and 20 days counted)

No		Province/ Municipality	Rainfall (mm)								
			1994	1995	1996	1997	1998	1999	2000	2001	2002
		Average	1558.97	1697.35	1406.94	1367.47	1336.47	2668.09	1866.56	1613.76	1355.10
1	p	Banteay Meanchey	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	p	Battambang	1318.00	1364.70	1355.90	1112.50	876.20	1299.30	1384.40	886.10	1182.50
3	p	Kampong Cham	1949.50	1612.70	2019.70	1317.50	1283.80	1836.90	1382.10	1310.00	1094.90
4	p	Kampong Chhnang	1539.30	1367.70	1009.40	770.00	1256.00	1037.40	1574.30	1184.50	1118.10
5	p	Kampong Speu	662.40	1134.60	1374.40	887.10	1120.40	1633.40	1863.80	1623.20	729.90
6	p	Kampong Thom	1857.10	1855.90	NA	NA	1322.60	1743.80	1769.90	1631.70	1483.60
7	p	Kampot	1927.60	1699.00	1207.90	1885.30	1188.80	2471.60	2189.10	2295.80	1503.10
8	p	Kandal	1518.30	1387.10	1318.20	1099.80	1125.20	1593.70	1735.10	118.30	1186.90
9	p	Koh Kong	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	p	Kratie	1490.50	1878.70	1340.80	1752.40	1537.60	2530.20	2093.60	1938.60	1694.20
11	m	Kep	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	m	Pailin	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	m	Sihanoukville	3564.70	3190.40	1979.30	2217.20	1878.30	3614.00	3536.00	3284.20	2892.10
14	p	Mondul Kiri	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	p	Oddar Meanchey	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	m	Phnom Penh	1223.50	1413.30	1338.20	1306.50	1380.90	15931.00	2155.10	1486.70	1221.50
17	p	Pursat	1303.40	1966.80	1557.40	1218.60	1407.20	1732.90	1562.40	1201.90	1368.30
18	p	Preah Vihear	NA	NA	NA	NA	NA	NA	NA	NA	NA
19	p	Prey Veng	1036.10	1471.20	1507.10	1119.20	1585.90	1641.90	1271.30	1477.20	1414.80
20	p	Ratanak Kiri	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	p	Siemreap	1123.70	1766.40	1197.00	1534.40	1240.20	1386.50	1593.70	1557.70	1166.70
22	p	Stung Treng	1795.70	1797.90	1352.50	2193.70	1554.50	2207.50	2414.60	1867.60	1307.40
23	p	Svay Rieng	1629.40	1892.20	1757.20	1884.50	1789.50	1873.00	2133.60	1588.40	1551.50
24	p	Takeo	819.60	NA	1193.10	604.00	1166.20	1539.30	1598.60	1525.60	1107.70
25		Tonle Bassac	1743.70	1359.00	1003.00	981.10	1006.70	1285.20	1473.90	1386.50	1013.50

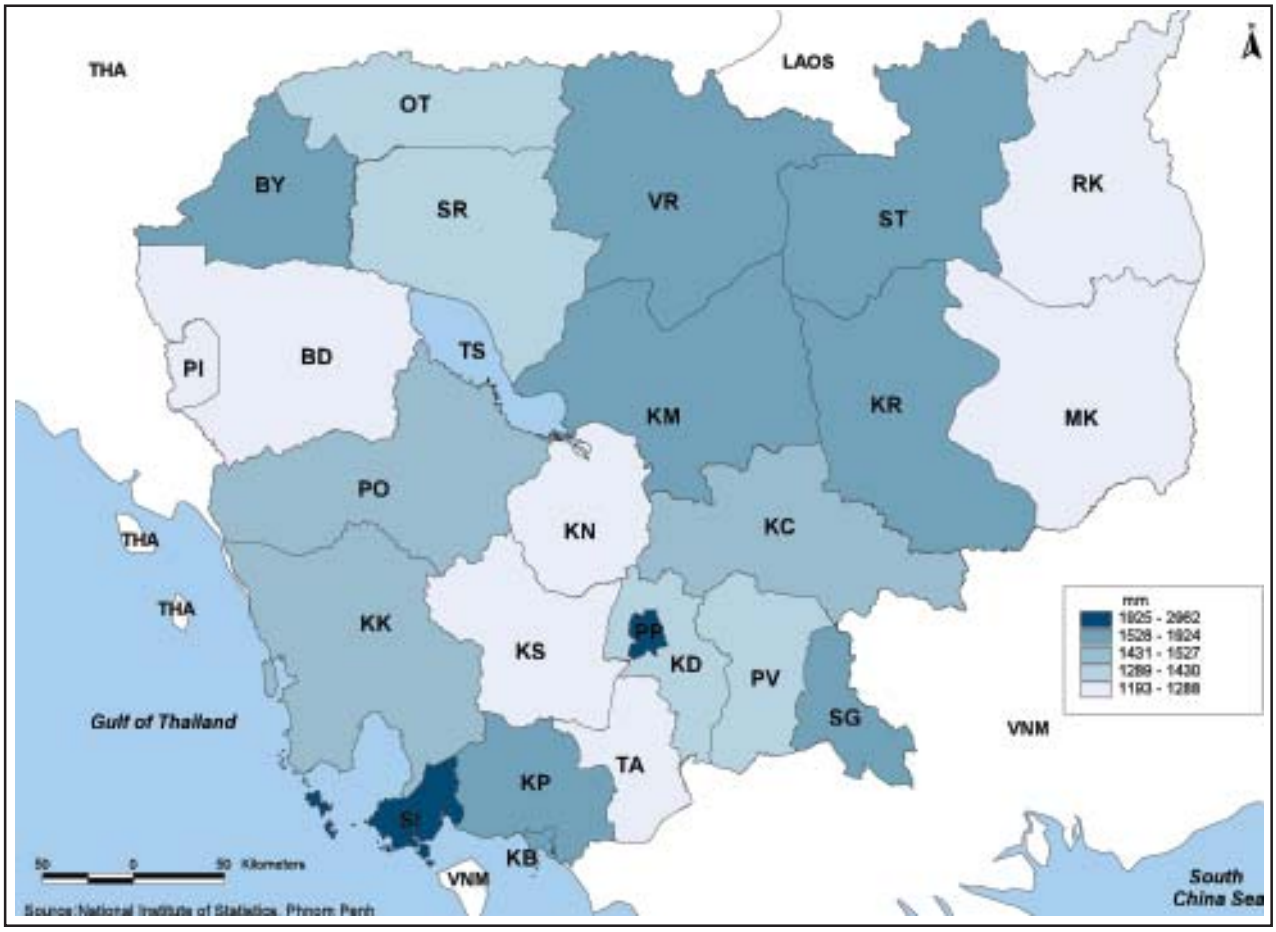
Source: Ministry of water Resource and Meteorology.

Table 2.23 - Rainfall and Instability

No		Province/ Municipality	Instablilty in Rice Yield	Instablilty in Rice Production	Instablilty in Maize Yield	Instablilty in Maize Production	Fluctua-tion in Rainfall	Spread of Rainfall	% of Irrigated Area To TGA	Water bodies as % of TGA Incl. Tonle Sap
1	p	Banteay Meanchey	0.264	0.205	0.366	0.659	NA	NA	5.82	7.54
2	p	Battambang	0.170	0.306	0.403	0.941	200.16	88.71	5.01	3.95
3	p	Kampong Cham	0.109	0.194	0.288	0.839	332.04	96.19	8.99	3.15
4	p	Kampong Chhnang	0.210	0.273	0.345	0.451	259.99	194.48	9.23	11.26
5	p	Kampong Speu	0.273	0.336	0.143	0.620	425.83	113.34	3.42	0.18
6	p	Kampong Thom	0.234	0.224	0.226	0.674	200.75	196.25	6.19	4.41
7	p	Kampot	0.169	0.295	0.190	0.345	459.78	424.19	14.85	0.47
8	p	Kandal	0.198	0.615	0.236	0.366	224.80	116.24	19.31	16.99
9	p	Koh Kong	0.137	0.235	NA	NA	NA	NA	0.44	0.00
10	p	Kratie	0.223	0.307	0.360	0.824	359.41	165.53	0.77	2.68
11	m	Kep	NA	NA	NA	NA	NA	NA	25.53	0.00
12	m	Pailin	NA	NA	NA	NA	NA	NA	0.48	0.00
13	m	Sihanoukville	0.195	0.228	NA	NA	702.28	422.88	11.55	0.19
14	p	Mondul Kiri	0.738	0.434	0.116	NA	NA	NA	0.22	0.01
15	p	Oddar Meanchey	NA	NA	NA	NA	NA	NA	9.31	0.08
16	m	Phnom Penh	0.138	0.140	0.078	0.332	4838.38	88.52	16.90	13.44
17	p	Pursat	0.119	0.124	0.356	0.546	252.08	128.78	2.20	4.01
18	p	Preah Vihear	0.110	0.242	0.327	0.775	NA	NA	2.17	0.00
19	p	Prey Veng	0.282	0.520	0.098	0.341	207.06	103.46	14.95	2.75
20	p	Ratanak Kiri	0.188	0.240	0.389	1.942	NA	NA	0.59	0.00
21	p	Siemreap	0.191	0.115	0.263	0.563	227.01	85.25	10.21	4.21
22	p	Stung Treng	0.297	0.676	0.351	0.480	386.83	139.59	0.47	1.90
23	p	Svay Rieng	0.223	0.284	0.503	1.087	183.27	141.81	36.18	0.27
24	p	Takeo	0.274	0.497	0.167	0.820	356.45	328.96	34.78	4.30

Source Ministry of Water Resources and Meteorology; http://www.faorapapcas.org/cambodia/busdirectory/search_results.asp
Note: Instability is measured by standard deviation of the annual growth rate which is found by taking first difference of natural logarithms.

Map 2.10 - AVERAGE ANNUAL RAINFALL IN 2002



metres. Data on annual river flows from other countries reveal that the country also receives 356 cubic kms of water from neighbouring countries and about 470 cubic km of water flows away from Cambodia to other countries.[41]

In 1987, water withdrawal[42]amounted to 0.2% of total renewable water resources; of this 94% was directed for agricultural use. At present, the available water resources are far above the level of current use. Estimates of current water use seem to be about 750 million cubic metres (MCM) per year and in 2001 the amount of water used for agricultural purposes was 61%.[43]

1) Rainfall

Cambodia receives most of its rainfall from the South-West monsoon, which occurs during the period between mid-May and November. The coastal regions receive the highest rainfall of about 3,000 mm/year, while the highlands and lowlands receive 2,500 mm/year and 1,400 mm/year, respectively. Sihanoukville and Kampot situated on the coast receive the highest annual average rainfall of up to 4,000 mm (Map 2.10).

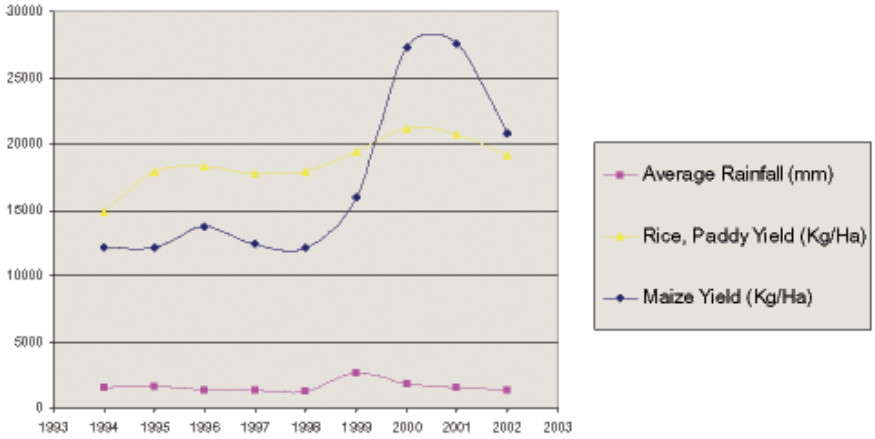
The monthly distribution of rainfall results in a wet season extending from April/May to November/ December and a dry season from December/January

[41] World Resources Institute "Earth Trends: The Environment Information Portal" www.earthtrends.wri.org.

[42]Water withdrawals refer to the total water removed for human uses in a single year and is measured in million cubic metres.

[43] Compendium on Environment Statistics, Cambodia, 2003

Figure 2.5 Year to Year Change in Rainfall and Yield (1993-2003)



to April. Rainfall peaks towards the last week of September and the first week of October (Nesbitt, In Nesbitt (Ed.) 1997)[44]. This is also the time when the river water levels in the plains and delta reach their highest levels.

For Cambodia, as a whole, annual rainfall data is available from 1994 to 2002. The movements of rainfall and crop yields were further examined. The plotted graph does not show synchronized movements of peaks and troughs both for paddy and maize (Fig 2.5). For additional information, the coefficient of variation of rainfall and the coefficient of variation of crop production were compared with each other at the provincial level (Table 2.21). The variations in crop production were much higher than the variations in rainfall. This would mean that production instability occurs in Cambodia not only due to rainfall fluctuations but also due to a number of other factors, such as poor moisture-retaining capacity of soils, related soil degradation, floods unrelated to rainfall fluctuations that destroy crops and areas under rice cultivation, changes in flood recession, etc. Thus, instability no doubt is caused by abiotic stress, though not directly related to rainfall fluctuations. Rain-fed upland rice, which constitutes no more than 1.3% of the total rice area, is probably dependent upon the rainfall fluctuations (Tables 2.23).

2) Surface Water

The major water bodies are the Tonle Sap Lake and the Mekong and Bassac Rivers. The Mekong River flows across the country over a distance of 486 kms, providing an annual flow of 500 billion cubic metres (BCM).

The Tonle Sap Lake encompasses an area of 2,600 sq km (250,000-300,000 hectares) in the dry season and is estimated to have a capacity of 72,000 BCM. However, during the rainy season, the water flow from the Mekong and Bassac Rivers increases the size of the lake to up to 15,000 sq km (1.0-1.6 million hectares). The frequent flooding of the rivers also creates an extensive wetland or floodplain region, which covers a region of about 20% of total land area. The Tonle Sap Lake is the seasonal breeding ground of a variety of fish, which eventually migrate to the Mekong River, its many tributaries and to the mangroves in the estuaries.

Near Phnom Penh, a confluence occurs between the Mekong and the Tonle Sap Rivers. The direction of

[44] Nesbitt, H "Mekong River Water: Will river flows meet future agriculture needs in the Lower Mekong Basin?" 'Water in Agriculture', ACIAR Proceedings No. 116,1997

Figure 2.6 Seasonal flood water flow in the Mekong River

Normal Flow

Wet Season (Reverse flow into the Tonle Sap)

Receding Flow During Dry Season

Source: http://www.thewaterpage.com/mekong_river.htm#Map

flow of the Tonle Sap River varies according to the season. In the height of the flood season, between June and September, when the level of the Mekong is high due to the glacial melt water flowing in from China and Tibet, waters flow through the Tonle Sap River north to the lake, increasing the size of the lake. The seasonal rise of the Mekong River floods almost 162,000 hectares around the lake, leaving rich silt when the waters recede. During the dry season the floods subside and the Tonle Sap River reverses its flow again to drain southeast wards into the Mekong River[45](Figure 2.6).

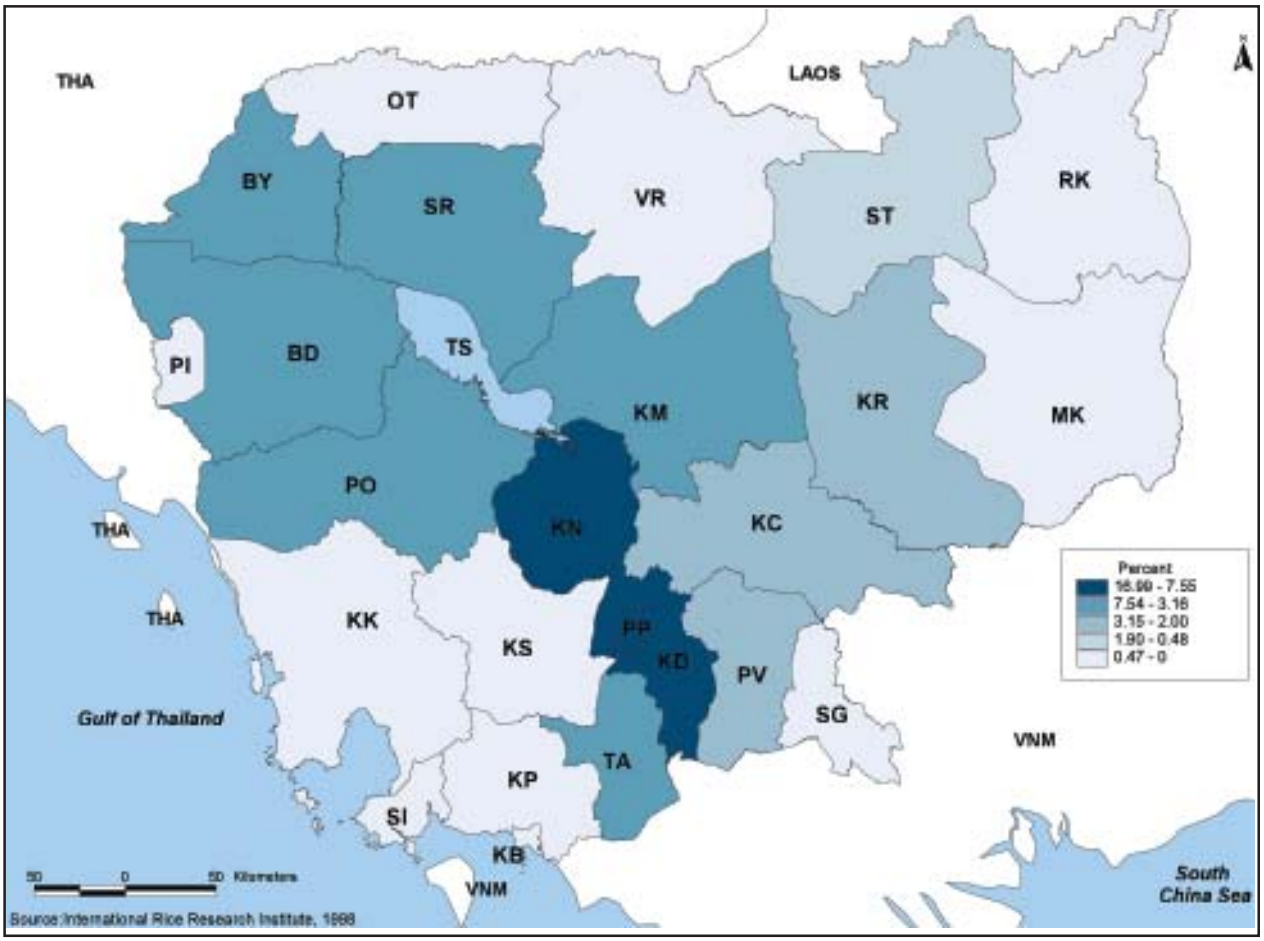
The flooded forests that line these riverbanks play an important role in maintaining the ecology of these wetland ecosystems. The receding waters provide fertile paddy fields, as well as a rich harvest of fish, crabs, frogs, snails and ants, all of which are eaten by people. Houses in the vicinity of flooding have small ponds to catch the water when the flood recedes. It is essential to preserve the ecosystem of these flooded forests as the basis for sustainable fish capture.

The provinces of Kampong Thom, Siemreap, Banteay Meanchey, Battambang, Pursat and Kampong Chhnang are the major beneficiaries of the Tonle Sap Lake. Phnom Penh, being the point of convergence of the Mekong and Bassac Rivers, possesses considerable surface water resources. Kandal too has almost 17% of its land area comprising water bodies. The eastern provinces of Mondul Kiri, and Ratanak Kiri, as well as Oddar Meanchey and Preah Vihear in the north, have very little or no water bodies. The coastal provinces of Sihanoukville and Kep also have few water bodies (Map 2.11). Over the years, the water surface area has decreased substantially with a loss of 181,000 hectares between 1985/87 and 1992/93. About 86% of this loss was in permanent water bodies, such as lakes and rivers. Wetlands and inundated forests were also converted into flooded paddy fields or floating rice fields. Increased deforestation results in soil erosion, which in turn increases sedimentation, thus reducing the surface area and depth of downstream river channels. Dams built upstream decrease the water flow and also cut off access of fish to their spawning areas.

To address and resolve the various threats to the Tonle Sap Lake, the Tonle Sap Biosphere Reserve was established in 2001 under the United Nations Educational, Scientific and Cultural Organisation (UNESCO) Man and Biosphere Program. Agencies, such as the Asian Development Bank (ADB), and donors, such as Japan and Australia, have contributed substantially towards ensuring a more holistic and sustainable use of water resources. Better management

[45] Royal Government of Cambodia, Ministry of Agriculture, Forestry and Fisheries www.fadinap.org/cambodia/Agplan20012005/chap1_2_8.html.

Map 2.11 - PERCENTAGE OF WATER BODIES TO TGA



of natural resources can be effected only through the devolution and decentralisation of responsibility to the commune and provincial level, with increased community participation. Farmers are being urged to stop clearing mangrove swamps around the lake to make way for new rice fields in the dry season.

The Mekong River Commission was formed through the 1995 Mekong River Agreement under the guidance of the UN Economic Commission for Asia and the Far East (ECAFE). The member nations are Cambodia, Lao PDR, Vietnam and Thailand. The Commission's objectives include ensuring sustainable agriculture in the Mekong Basin.[46]

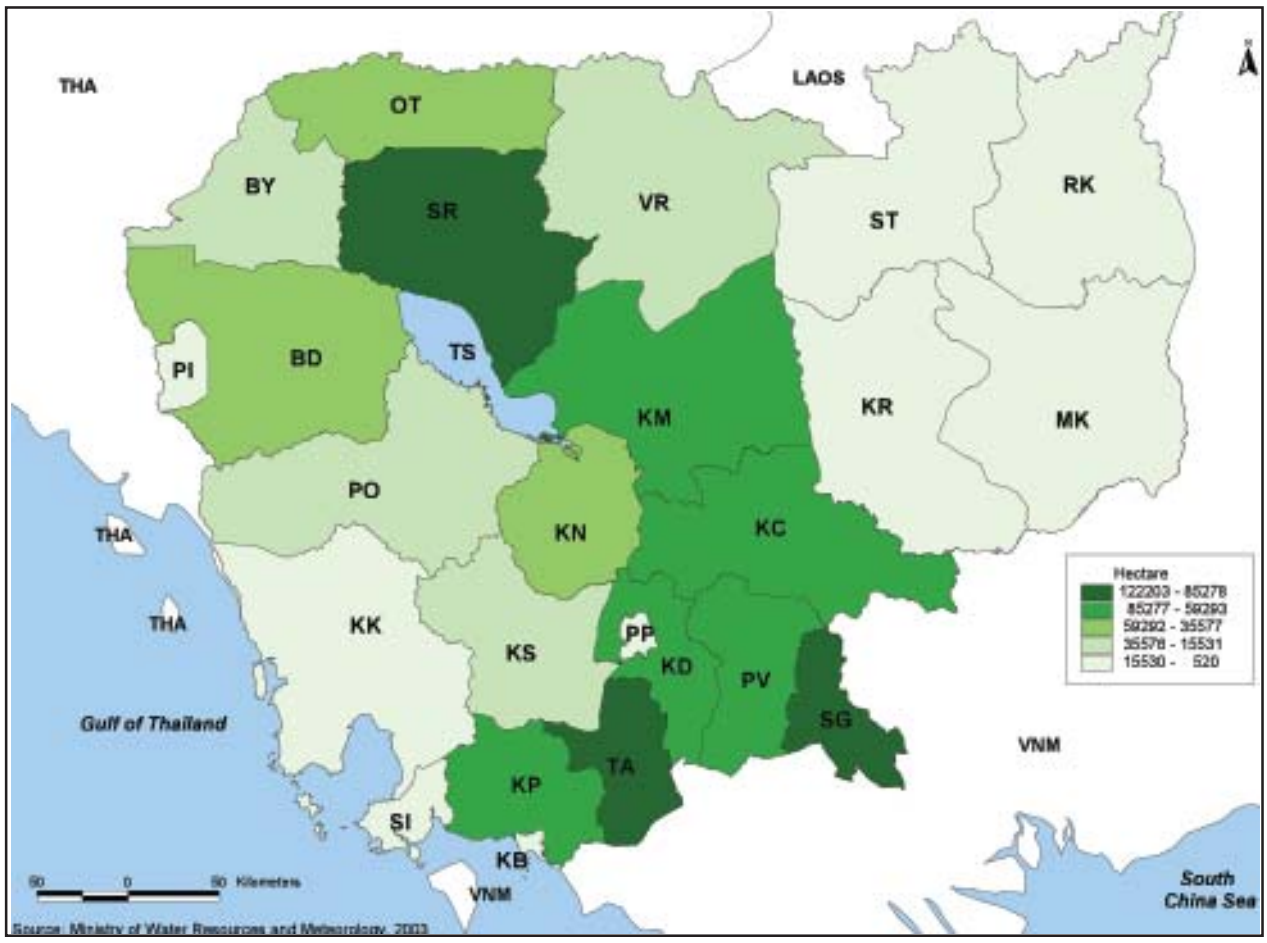
3) Groundwater

Cambodia is estimated to have 17.6 BCM in groundwater resources. Extensive shallow groundwater reserves are known to exist around the Tonle Sap Lake and beside the Bassac and Mekong rivers. Farmers in the provinces of Kandal, Takeo, Svay Rieng and Prey Veng have taken advantage of these reserves by installing cheap shallow tube wells to irrigate 1-2 hectares of the dry season crop.[47]Studies have shown aquifer productivity to be higher in the eastern region as compared to the western region. While the groundwater resource is the most important resource being used, there is very little data on its distribution, quantity and quality.

[46]Mekong River Commission www.mrc.mekong.org.

[47] Nesbitt, H "Mekong River Water: Will river flows meet future agriculture needs in the Lower Mekong Basin?" 'Water in Agriculture', ACIAR Proceedings No. 116,1997

Map 2.12 - TOTAL IRRIGATED AREA (HA)



In a comparative study conducted for the provinces of Takeo and Kampot in 2001, it was found that the major obstacle for successful double cropping was the lack of tube wells and pumps to access groundwater. It was found that, although farm incomes and food supply were higher in both provinces, farmers in Kampot who used water from small-scale reservoirs, such as ponds, ditches and canals near rice fields, were limited in their capacity to cultivate the second crop because the capacity of these storages could not meet the demands of larger fields or lengthy droughts. In Takeo, however, farmers tapped into groundwater resources by using pumps and wells while farming the second crop in the early wet season. Thus, the lack of tube wells and pumps to access groundwater is a key obstacle to the expansion of double cropping.[48]

4) Irrigation

Despite Cambodia's vast water resources, very little is harnessed for the purpose of irrigation. Most of the irrigation projects appear to be small to medium-scale projects that cover between 200 and 5,000 hectares each. A distinctive irrigation mechanism adopted in recession rice cultivation is known as "colmatage farming". In this system, canals lead water from the major rivers (Mekong and Bassac) during the flood season into lower elevation land. Such farming is

[48] Chea, S., Cramb, R.A and Fukai, S. "The Economics of Rice Double-Cropping with Supplementary Irrigation in the Rain-Fed Lowlands of Cambodia: A Survey in Two Provinces", 'Water in Agriculture', ACIAR Proceedings No. 116, 2004.

therefore dependent on the level and duration of river floods. The colmatage system provides sediment control, replenishes soil fertility and allows land reclamation.

Very little research has gone into the impact of irrigation on production and productivity of agriculture. The observations made in this section need to be substantiated further. In 1999, only 17% of the total annual crop area was irrigated. Out of the 841 irrigation systems in 1999 only 21% were operational.[49] However, the total irrigated area has increased steadily from 276,383 hectares in 1994 to 443,474 hectares in 2001.[50]About 1.04 million hectares of irrigated area, constituting about 34 % of the cropped area at present, has been reported by the Ministry of Water Resources and Metereology.[51](Appendix 5.1, column one and Map 2. 12).

To gain some insights, the percentage of area under rice cultivation to the total area under 12 major crops was compared with the percentage of irrigated area to the total area under 12 major crops across the provinces. This was undertaken to examine if the provinces with larger percentages of areas under irrigation were also the provinces with large areas of rice cultivation. There was no correlation between the series, showing that the irrigation may have gone to crops other than rice.

Another interesting finding that needs further study is the negative relationship between rice yield and rice area irrigated across the provinces. This may mean that irrigation does not contribute to higher rice yield–it does not increase the productivity of rice cultivation– rather, it is used to expand the area under rice. Irrigation merely brings in more land under cultivation. Another possible explanation is that irrigation may have been largely through flooding, which added to production but at the same time, reduced yields. Irrigation, to be truly successful, must be controlled and combined with productivity-enhancing methods, such as the use of fertilizers or higher yielding seed varieties.

It has been observed that the Cambodian terrain is not very conducive to the effective functioning of large-scale dams. Besides, structures such as dams can significantly affect fisheries by blocking migration and spawning areas, altering water quality and quantity, changing the temporal and spatial relationship of the flood cycle and degrading or fragmenting aquatic habitats. Loss of such habitats may have drastic consequences for the productivity of fisheries .[52]

In the southern lowlands, with limited flood control during the wet season and storage of flood water, farmers who are predominantly rice cultivators have been able to grow a second and a third crop. This is unlike the upland areas where agriculture is predominantly shifting cultivation, and the farmers are able to grow only one crop a year.

The problem is that almost 54% of the irrigable land in Cambodia is located in poor 'acrisol' soils, diminishing the economic viability of providing irrigation to these soils. However, about 8 million hectares of irrigable fertile land in Cambodia is not irrigated. These areas should be the main priority. According to government information, only 1.04 million hectares are currently irrigated. Expansion of another 7.0 million hectares would increase production substantially. Further, there is considerable scope for lift irrigation through pump sets from rivers and canals to the required locations. At present, manually operated pump sets provide supplementary irrigation to rice grown in the dry season in areas flooded during the monsoon. As this area is closer to sea level, heavy-duty pumps are not necessary. There is considerable scope for shallow tube wells and lift irrigation in the dry season in lands adjacent to the rivers for diversification through multiple cropping.

[49]Compendium on Environment Statistics, Cambodia, 2003

[50]Ministry of Agriculture" Agricultural Development Plan, Website www.maff.gov.kh accesses in May 2005

[51] Province level data and national data provided by the Ministry of Water Resources

[52]Asian Development Bank "Future Solutions Now: The Tonle Sap Initiative", November 2004

Table 2.24 - Area under Rice Cultivation by Province and Ecosystem, 2000 (in Ha)

No		Province/Municipality	Upland Rice	Deepwater Rice	Rainfed Rice (0-30cm)	Rainfed Rice (>30cm)	Irrigated Rice (Wet)	Irrigated Rice (Dry)
1	p	Banteay Meanchey	0	6080	79433	14018	0	0
2	p	Battambang	0	28880	87862	28621	1000	2000
3	p	Kampong Cham	5246	1520	94631	50955	20394	20394
4	p	Kampong Chhnang	281	6080	42352	22536	5518	7018
5	p	Kampong Speu	19	0	66696	11770	891	891
6	p	Kampong Thom	1216	13680	71054	23518	2063	2563
7	p	Kampot	66	3040	105165	18558	950	950
8	p	Kandal	1272	9120	12062	1111	29782	39782
9	p	Koh Kong	817	0	5327	940	4	4
10	p	Kratie	990	0	11859	3953	4468	4468
11	p	Mondul Kiri	2000	0	4672	824	4	4
12	p	Pursat	0	7600	46946	15649	670	670
13	p	Preah Vihear	1100	0	14441	2548	11	11
14	p	Prey Veng	0	18240	99720	53695	33300	33300
15	p	Ratanak Kiri	6200	0	11041	1948	8	8
16	p	Siemreap	3790	13680	108740	35580	7015	9015
17	p	Stung Treng	1046	0	10118	3373	9	9
18	p	Svay Rieng	185	21280	104614	18461	2702	2702
19	p	Takeo	0	22800	83404	39525	31430	41430
		Total	24228	152000	1060137	347583	140219	165219

Source: http://gismapserver.irri.cgiar.org/gislab/arse_kh0.html. Accessed May 2005.

2.5 Production Prospects[53]

2.5.1 Rice Ecosystems and Rice Varieties

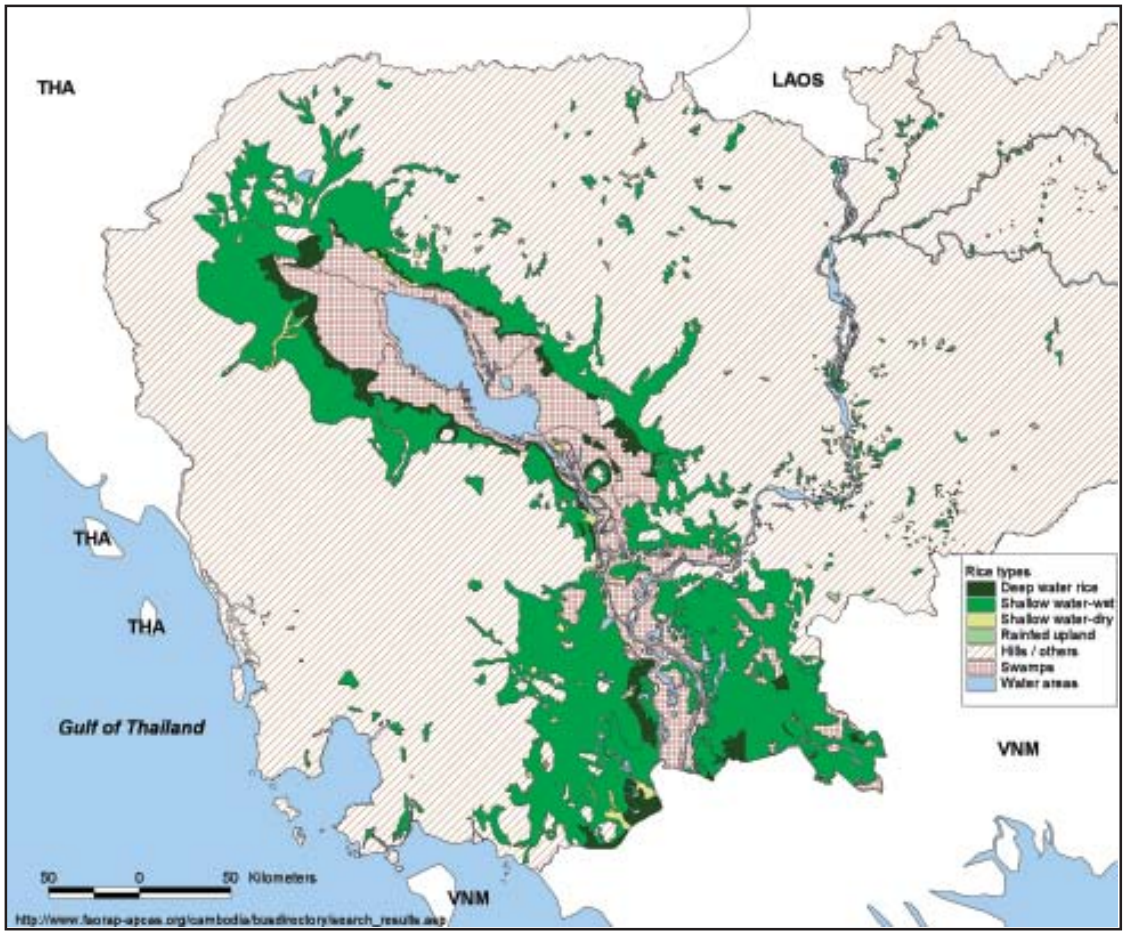
Classification of the rice ecosystems at the initial level in Cambodia is based on wet and dry seasons. Wet season rain-fed rice ecosystems associated with rainfall form about 84% of the total area under various rice ecosystems. Within this broad category, rice ecosystems are further categorized as:

1. Rain-fed lowland rice ecosystems that occupied an area of 75% of the total area in the mid-nineties. The provinces of Kampong Cham, Kampong Chhnang and Battambang have more than 75% of rice area under rain-fed lowland rice.

2. Upland rice ecosystems that constituted about 1.3% of the rice cultivated in the nineties. However, trials conducted in these soils have shown that they have relatively higher organic matter and that they respond well to fertilizer application and improved management

[53] This section is based on Javier, E.L,Nesbitt H "Mekong River Water: Will river flows meet future agriculture needs in the Lower Mekong Basin?" 'Water in Agriculture', ACIAR Proceedings No. 116,1997

Map 2.13 RICE TYPES



They are spread along the upper reaches of the north-eastern provinces of Ratanak Kiri, Kampong Cham, Siemreap, Mondul Kiri, and to a lesser extent, in the provinces of Kandal, Kampong Thom, Preah Vihear and Stung Treng.

3. Deep water rice ecosystems that constituted about 8% of the rice cultivated in the nineties. Deep water rice ecosystems are characterised by low lying areas that accumulate floodwater up to 50 cm or more for at least one month during its growing period. Deep water rice ecosystems are present in floodwater depressions of the Tonle Sap, Mekong and Tonle-Bassac Rivers. This includes the provinces of Battambang, Takeo, Svay Rieng, Prey Veng, Siemreap and Kampong Thom, and to a lesser extent, Kandal, Pursat, Kampong Chhnang, Banteay Meanchey, Kampot and Kampong Cham.

4. Flood plain ecosystems in receding flood areas: The high fields and the low fields are both subject to recurring periods of flood and drought. High fields are more drought-prone and the lowlands are more flood-prone. Soil fertility has been found to increase from the high fields to the low fields.

5. Irrigated rice that includes rice in both wet and dry seasons. Irrigation may be partial or full. Four typologies of irrigated rice ecosystems are present: partly irrigated early wet season rice (EWS), partly irrigated wet season rice (WS), dry season fully irrigated rice and partly irrigated dry season recession rice. Irrigated rice cultivation in Cambodia is about 16.2% of the total area under rice cultivation. Of this, about half is occupied by dry season rice. Irrigated rice ecosystems (both wet and dry) are spread along the flood basins of the Tonle

Table 2.25 - Distribution of Traditional Varieties

Rice Culture Type	Planted Area (Ha)	Number of Provinces	% of Total Area
Wet Season			
Early:			
Local Varieties	249533	21	14.00
IR Varieties	52928	11	2.90
Medium:			
Local Varieties	612694	21	34.30
IR Varieties	1780	2	0.10
Late: Local	571492	21	32.10
Deep Water:			
Local Varieties	71616	15	4.00
Upland			
Local Varieties	31838	15	1.80
Dry Season			
Local Varieties	15827		
IR Varieties	174673		0.90

Source: Cambodia and IRRI: Facts about Cooperation; http://www.irri.org/media/facts/pdfs/cambodia.pdf

Table 2.26 - Common Lowland Rice Varieties

No	Rice Variety	% of National Rice Growing Area	Aver.Yield (T/Ha)
1	Neang Minh	22.60	0.80
2	IR66	10.80	2.30
3	Phka Khney	6.20	1.30
4	Bonla Phdau	6.10	0.70
5	Smeu	5.90	0.80
6	All Other Varieties #	48.40	1.70

Farmers named 43 additional varieties, each accounting for less than 4% of the rice growing area.
Source: Gary C. Jahn, Pol Chanthy, Pheng Sophea, Khiev Bunnarith, and Chhorn Ne1, 1999.
Pest management and rice production: Practices of farmers in upland and deepwater rice ecosystems of Cambodia, baseline survey report no. 7, Cambodia-IRRI-Australia Project, C.

Sap Lake, the Mekong and Bassac Rivers. The provinces of Prey Veng, Takeo, Kandal and Kampong Cham have the largest spread of irrigated wet season rice, each with more than 40,000 hectares. Siemreap, Kampong Chhnang, Kratie and Svay Rieng have a lower share of irrigated wet rice. Rice grown under purely dry season is said to be fully irrigated (Table 2.24 and Map 2.13).

Rice ecosystems of Cambodia face several challenges and stresses. Frequent changes in moisture content during the growing season poses severe abiotic stress to production. Soils in several areas have poor fertility and high iron-toxicity. Inputs, such as improved seed, water and fertilizer, have still not reached many of the areas. There is a characteristically low intensity of cultivation, and the production per hectare is low. Furthermore, people involved in rice cultivation are poor and market access has been difficult. There is also very little value addition that can significantly increase revenues.

Cambodia is rich in traditional varieties uniquely adapted to the diverse local environments and they are far larger in terms of area covered than improved varieties. About 4,000 accessions of traditional Cambodian rice varieties and about 2,000 accessions of wild rice have been collected, evaluated and preserved so far.[54] Apart from domesticated rice, wild rice of the Oryza species, such as O.nivara and O.rufipogon, have been identified. Many of them are glutinous varieties, while aromatic varieties are also present. The early duration varieties mature in less than 120 days; the medium duration varieties between 120 and 150 days; and the late duration varieties take more than 150 days for maturation (Tables 2.25, 2.26, 2.27, and 2.28).

[54] "Cambodia: Problems, Priorities, Progress and Opportunities" http://www.irri.org/corra/2003%20Country%20Reports/Cambodia_rep.doc

[55] Food and Agricultural Organization "Report of the 22nd session of Asia and Pacific Plant Protection" http://www.fao.org/documents/show_cdr.htm

Table 2.27 - Common Rice Varieties Grown in Upland Fields in Bantey Srei District, Siemreap Province

No	Rice Variety	% Farmers Planting Variety	% of Upland Rice Area Under the Variety	Average Yield, T/Ha
1	Srau Rit	36	35	0.70
2	Rit Chambak	15	16	0.70
3	Phnea Proom	14	14	1.10
4	Neang Kuy	12	9	0.70
5	Neang Mon	5	6	0.30
6	Rit Sar	3	6	0.50
7	Other Varieties #	15	14	0.60

other varieties include 7 varieties. Each of which is grown in less than 5 percent of the upland rice area.

Source: Gary C. Jahn, Pol Chanthy, Pheng Sophea, Khiev Bunnarith, and Chhorn Ne1, 1999. Pest management and rice production: Practices of farmers in upland and deepwater rice cosystems of Cambodia, baseline survey report no. 7, Cambodia-IRRI-Australia Project, C.

Constraints to sustained production

Rice productivity in Cambodia is the lowest in Asia. This is a result of high moisture stress (excess as well as deficient) faced in rice ecosystems. One of the important moisture stresses is the recurring floods and droughts that are a part of the unique Mekong-Tonle Sap hydrology, compounded by the erratic quantity and spread of rainfall received. Inadequate moisture can cause management difficulties, such as a delay in seed bed establishment and poor land preparation. Excess moisture may also cause an overgrowth of weeds and the production of less vigorous

Table 2.28 - Common Rice Varieties Grown in Deepwater Fields in Kandal and Siemreap Provinces

No	Province	Rice Variety	% Farmers Planting this Variety	% of Upland Rice Area under the Variety	Average Yield, T/Ha
1	**Kandal**	Srau Kraham	9	14.5	1.7
		Sambak Kraham	87	83.3	1.7
		Sambak Sar	2	1.3	1.3
		Srau Leung Tuk	2	1.2	0.5
2	**Siemreap**	Srau Vear	12	12.0	0.5
		Vaer Kralay	2	3.0	1.3
		Neang Khiev	3	1.0	0.5
		Vear Kraham	51	53.0	0.5
		Vaer Sar	32	31.0	3.9

Source: Gary C. Jahn, Pol Chanthy, Pheng Sophea, Khiev Bunnarith, and Chhorn Ne1, 1999. Pest management and rice production: Practices of farmers in upland and deepwater rice ecosystems of Cambodia, baseline survey report no. 7, Cambodia-IRRI-Australia Project, C.

seedlings, contributing to substantial declines in yield. A study conducted by the FAO/WFP[55] in 2000 revealed a reduction in the rice-harvested area of about 400,000 hectares due to floods and droughts.

Non-periodicity of flooding is one of the major constraints in deepwater rice ecosystems. On-farm trials of deepwater rice for crop improvements conducted at several locations in Kandal, Pursat, Takeo and Kampong Chhnang, reveal that considerable variations existed, both temporally and spatially, in onset and duration, and the maximum depth to which water levels went up (Javier E.L., In Nesbitt (ed.) 1997).

The soils on which rice is predominantly cultivated in rainfed lowlands and deepwater environments are mostly sandy loam and clay. Water logging is therefore a serious problem. These soils have generally poor soil fertility, and deficiencies of phosphorous and nitrogen is commonly reported. Organic matter levels are also quite low.

Some of the chemical constraints include salinity or alkalinity, which has affected approximately 1.3 million hectares, iron toxicity, which has affected approximately 7 million hectares, and acid sulphate soils, which has affected about 2 million hectares[56]. However, a lot of these soils are amenable to improvements in soil fertility.

Other economic constraints lead to inadequate crop intensification. These are closely linked to inadequate availability of labour, farm power and lack of access to credit to purchase fertilizers or farm machinery, etc. (Nesbitt (Ed.) 1997).

Other land possession and management related problems also exist. Many farmers do not own contiguous lands. Their lands are often spread over several areas and across different ecosystems. Thus, a single farmer may have a plot in the high fields, a plot in the low fields or rainfed lowlands, or may also have a plot in the deepwater ecosystem or dry season ecosystem. They are often not close to the home and daily monitoring becomes very difficult.

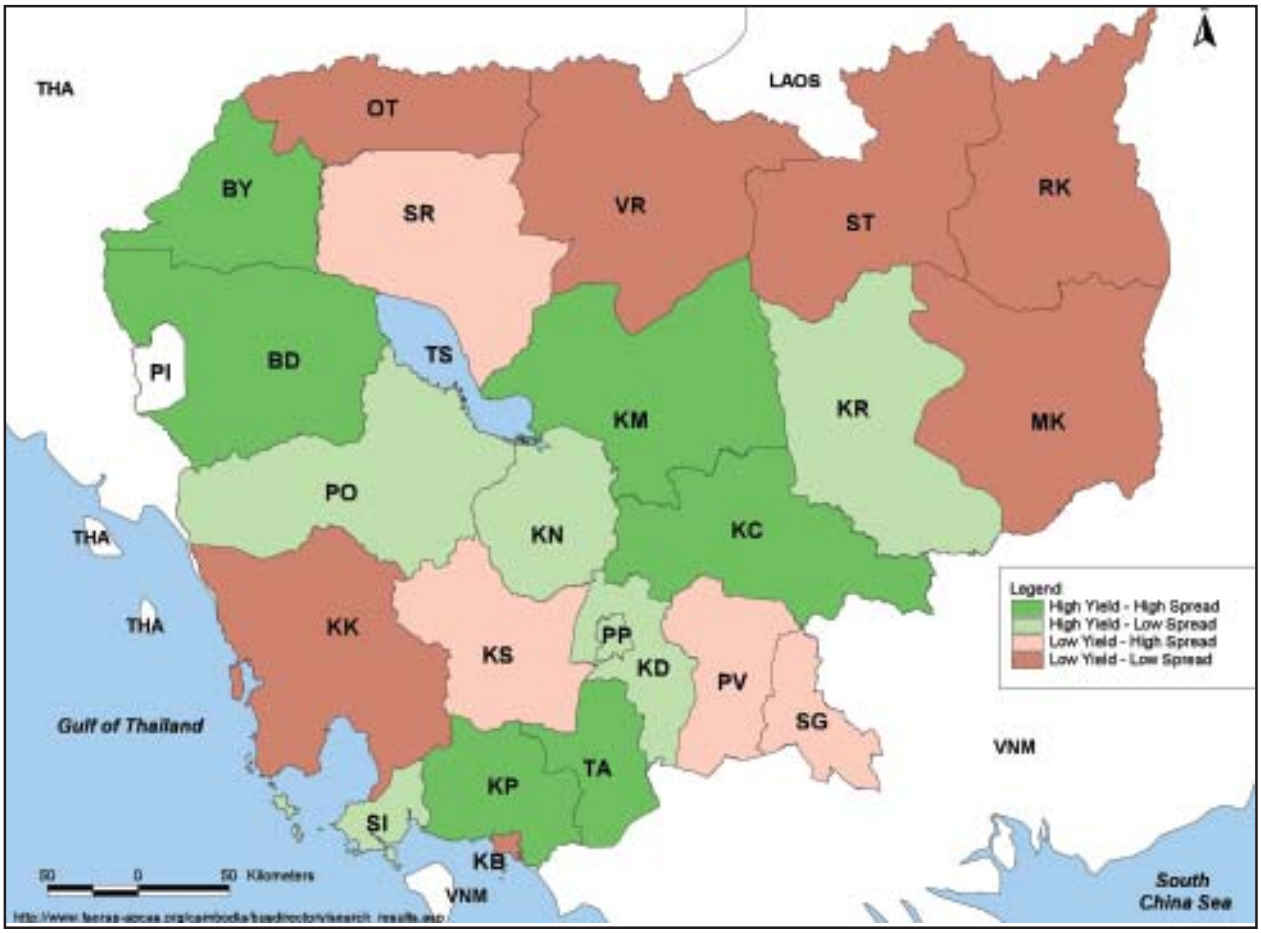
Irrigation and effective water management is a major constraint to improved yields. Apart from the irrigated rice ecosystems mostly concentrated in the active floodplains, the largest part of rainfed lowland ecosystems and deepwater rice ecosystems do not have any supplementary irrigation developments or any form of water management. As noted earlier, a study conducted in a few villages in Kampot reported that some farmers did not know about the use of groundwater for irrigation[57]

Table 2.29 - Composite Index of Paddy Area and Yield

Rank	Category	Area of Paddy(%)	Yield (T/ha)	Provinces
4	High Yield and High Spread	34.80	1.96	Banteay Meanchey, Battambang, Kampong Cham, Kampong Thom, Kampot and Takeo
3	High Yield and Low Spread	18.80	1.79	Kampong Chhnang, Kandal, Kratie, Sihanoukville, Phnom Penh and Pursat
2	Low Yield and High Spread	44.51	1.30	Kampong Speu, Prey Veng, Siemreap and Svay Rieng
1	Low Yield and Low Spread	10.96	1.29	Koh Kong, Kep, Mondul Kiri, Oddar Meanchey, Preah Vihear, Ratanak Kiri, Stung Treng

Source: Based on International Rice Research Institute, 1998.
http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp

Map 2.14 - DISTRIBUTION OF PADDY (CULTIVATED AREA AND YIELD)



2.5.2 Strategy to Increase Production and Productivity

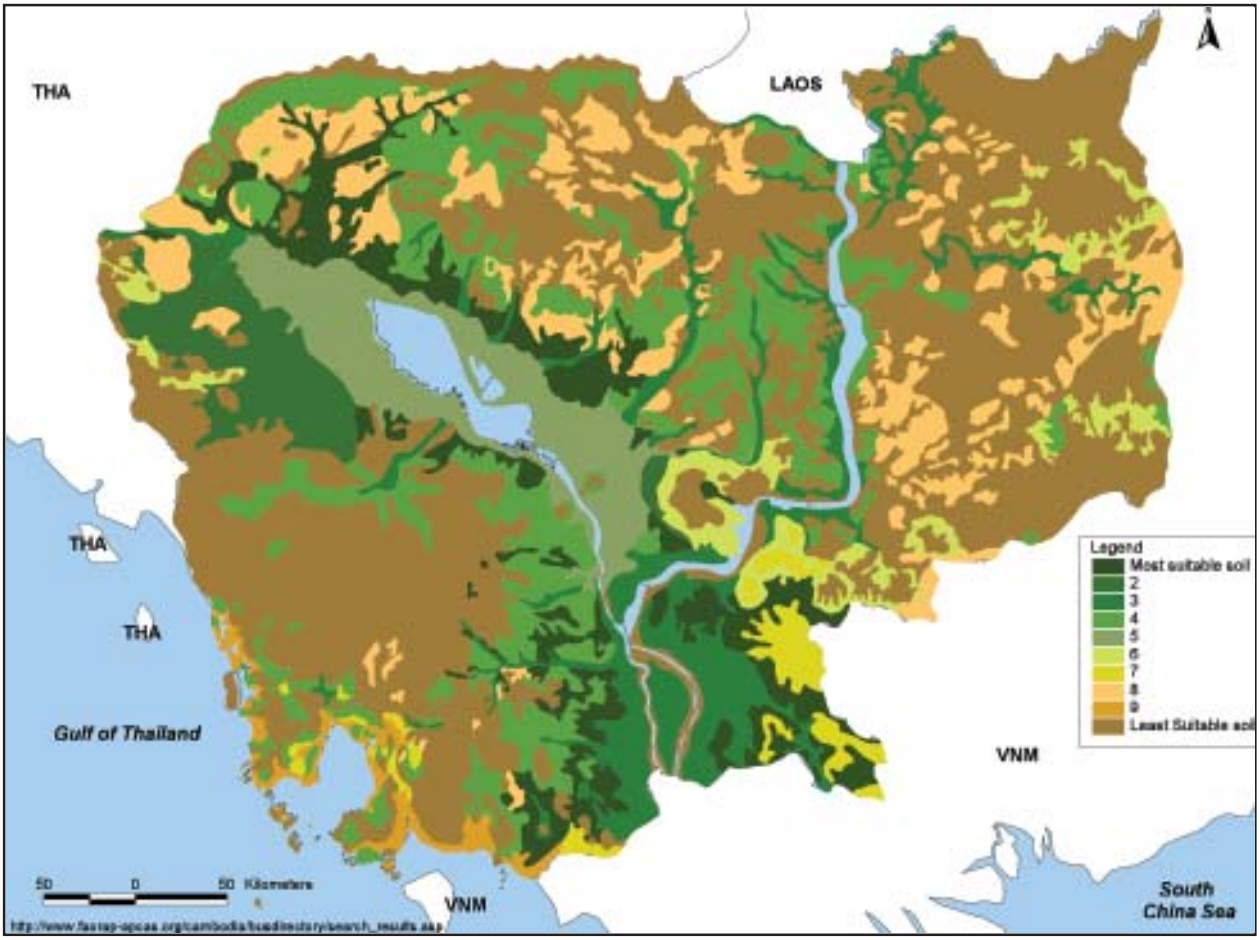
Since rice is the staple food of Cambodia as well as the neighbouring countries, it is important to ensure a sustained improvement in production and productivity of rice so that sufficient food grains are available for consumption and export. In this section, a preliminary attempt is made to identify the provinces where production could be improved at a minimal cost and where it is possible to enhance yields and ensure market linkages. High Yielding Varieties (HYV) have also been identified for propagation and extension. This exercise is only an example to show how available data may be used to guide policy decisions.

The analysis is in three steps: The first step is to identify some provinces as candidates for productivity enhancement measures. The land use map (IRRI)[58] of 1997 was overlaid on the province map of Cambodia. Further, the area under paddy was estimated province-wise with the help of GIS techniques. The soils which

[56]Hae fele, S.M, Altin , G, Kam, S.P & Johnson , D.E 'Improving Farmers Livelihood in Rain - Fed Rice - based Lowlands of Asia', The International Rice Research Institute , Philippines , http://www.tropentag de/2004/abstracts/full/128.pdf

[57]Chea, S., Cramb, R.A and Fukai, S. "The Economics of Rice Double-Cropping with Supplementary Irrigation in the Rain-Fed Lowlands of Cambodia: A Survey in Two Provinces", 'Water in Agriculture', ACIAR Proceedings No. 116, 2004

Map 2.15 - RANKING OF SOIL TYPES



are suitable for paddy cultivation have been identified as follows. The provinces were ranked separately into four categories, ranging from one to four, according to the levels of yield and the extent of area cultivated. The provinces ranked as four have the highest yield and those ranked as one have the lowest yield. Similarly provinces ranked as four have larger areas under paddy cultivation, and those ranked one have smaller area under paddy cultivation. From these rankings, combinations of provinces were identified and given a composite index ranging from one to four: 1. High yield and large area (spread), 2. Low yield and large area, 3 High yield and small area and 4. Low yield and small area

The rationale behind this approach is that the soils in which the rice yield is high are likely to be better suited to grow rice than the soils in which the yields are low. Second, the larger the area under rice, the better would be the incentives for production of rice. It has been assumed that the areas with higher yields and larger area under rice have the most suitable locations for rice cultivation. The types of soils in these locations are assumed to be the best soils for rice cultivation in Cambodia. We have also assumed for the sake of analysis that the province in which the area is large and yields are low is a candidate for further attention since extension activities could readily transfer technology to improve yields.

[58]International Rice Research Institute

Table 2.30 - Soils Suitable for Paddy Cultivation as Derived from the Yield and Area Data

No	Soil *	Suitability for Paddy	CAM-IRRI-AusAID Report **
1	Cultural Hydromorphics	Most Suitable	Well suited
2	Brown Hydromorphics		Well suited
3	Alluvial Lithosols		Well suited with irrigation management
4	Red-yellow Podzols		Less suited
5	Lacustrine Alluvial Soils		Well suited
6	Regurs		Moderately suited with soil management
7	Alumisols		Moderate to well suited
8	Plinthite Podzols		Less suited
9	Coastal Complex		Not referred
10	Grey Hydromorphics		Well suited with irrigation management
11	Acid Lithosols		Not referred
12	Latosols		Moderately suited
13	Basic Lithosols		Moderately suited with soil management
14	Brown Alluvial Soils		Suited with irrigation management
15	Planosols	Least Suitable	Not referred

Source: * - Based on Soil Map, International Rice Research Institute -1998** - Based on Cambodia- IRRI - Australia Project, "The Soils used for Rice Production in Cambodia, Edited by P.F. White, T. Oberthur and Pheav Sovuthy.

First step

As a first step, it is suggested that experimenting with a complete change in cropping patterns of paddy, on the basis of soil suitability in non-traditional areas, is not advisable for economic and ecological reasons. If such areas are sparsely populated and forested, there will be a delicate ecological balance. Moreover, if a high level of investment is needed for crop pattern change, only commercial ventures are possible. In such cases, the benefits of improving rice production will not reach the poor and subsistence farmers resulting in economic inequity, but would help boost exports. These ventures may, however, receive a priority at a latter stage if the international price is favourable. It is clear, therefore, that production incentives, and suitability of a location to rice cultivation, depend upon a number of factors other than soil types.

For the purpose of analysis, we have used a twofold index of area and yield. Thus, for example, Kampong Thom, Kampong Chhnang, Battambang, Banteay Meanchey, Takeo and Kampot have a rank four in yield and four in area under cultivation, and are given rank four in the composite index (Table 2.29 and Map 2.14). They are ranked four as the most suitable provinces for rice cultivation.

Kandal, Phnom Penh, Kampong Chhnang, Pursat, Kratie and Sihanoukville have high yields with

Table 2.31 - Extent of Suitable Soil Types in the Provinces (Ha)

Soil Types	Kampong Speu	Prey Veng	Siemreap	Svay Rieng	Total Area
Cultural Hydromorphics	49126.80	137283.40	165493.66	94103.35	446007.21
Alluvial Lithosols	14634.98	151452.50	18836.09	29756.36	214679.93
Red-yellow Podzols	59266.01	-	22016.74	-	81282.75
Lacustrine Alluvial Soils	0.07	-	7343.87	-	73743.94
Regurs	-	1262.05	-	-	1262.05
Alumisols	-	32489.86	-	77995.77	110485.63
Plinthite Podzols	5510.23	-	36776.09	-	42286.32
Grey Hydromorphics	3239.24	-	18083.15	-	21322.39
Acid Lithosols	8478.49	-	4335.23	-	12813.72
Brown Alluvial Soils	-	97.62	-	-	97.62
Planosols	2066.52	-	-	-	2066.52
Grand Total	142322.34	322585.43	272884.83	201855.48	939648.08

Source: Based on the Soil Map, IRRI-1998

less area of paddy cultivation and they are given the rank three as suitable provinces with constraints to area expansion. The other provinces of Prey Veng, Siemreap, Kampong Speu and Svay Rieng have a high spread of paddy cultivation with low yields. Hence, these provinces are put in category two. They could be identified as candidates for potential yield improvements and the areas of attention for future growth in paddy cultivation. Koh Kong, Mondol Kiri, Preah Vihear, Ratanak Kiri, Stung Treng, Kep and Oddar Meanchey have a low spread of paddy cultivation with low yield and they are given the rank one as the least suitable provinces for rice cultivation. This analysis is done purely based on data for the yield and area of paddy cultivation available in 1998.

Second Step:

The map from the first step was overlaid on the rice soil type map to examine if these provinces do have soil types suitable for paddy cultivation. The index map overlaid on the soil types map was used for further analysis to see if they do have soils suitable for paddy cultivation. If the map shows that these identified provinces have suitable soils, then the task of evolving strategies for production and productivity enhancement is easier. For the present, the exercise only identifies the provinces with higher and lower soil suitability for rice cultivation.

Table 2.32 - Area of Suitable Soils (in Ha)

Suitable Soil	Kampong Speu	Prey Veng	Siemreap	Svay Rieng	Total
Total Suitable Soils	123027.86	289997.95	213690.40	123859.70	750575.90
Suitable Soils under 4 Rice Ecosystem					
(a) Deep Water Rice	-	13240.10	13500.61	2033.47	28774.18
(b) Rainfed Upland Rice	-	-	71.28	-	71.28
(c) Shallow Water-dry Season	1764.95	-	11927.09	-	13692.04
(d) Shallow Water-wet Season	99539.12	259699.04	128553.25	112852.91	600644.32
Total	101304.07	272939.14	154052.23	114886.38	643181.82

Source: Based on the Soil Map, IRRI -1998 and Rice Ecosystem Map, IRRI-1998

The final map gives the soil types of the province, as per the composite index types. The results are given in tabular form and geographically depicted in the map. It is found that cultural hydromorphic, brown hydromorphic, alluvial lithosol, red yellow podzol, lacustrine alluvial, and regurs soils are the most suitable in that order of priority. Here we presumed that a high index meant better suitability. The assumption has been that provinces ranked four with high yields and high area are the best suited ones for paddy cultivation and the existing soil types, obviously, must be the ones that enable such high productivity. (Map 2.15.)

The Third Step:

To cross-check the soil type suitability with other scientific studies, the available data of the CAM-IRRI-AusAID project has been used. The rankings of soil types from the analysis are very close to the ranking of actual suitability defined in the scientific study. Almost equivalent ranking was also observed, except in the case of red yellow podzols and brown alluvial soils. Brown alluvial soil is found to be low yielding compared to other soils in the analysis, while it was described as well suited for paddy cultivation with good irrigation practices by the CAM-IRRI-AusAID project. The error could be due to the small area of brown alluvial soil under paddy cultivation in our analysis.

The extent of suitable soils in the provinces of paddy cultivation assigned rank two, and identified for improvement (low yield and large area), has been analysed. It shows that the total extent of the most suitable soil, cultural hydromorphic, in the provinces of Kampong Speu, Prey Veng, Siemreap and Svay Rieng is 446,000 hectares. Rice ecosystems (deep water, rain-fed upland, shallow water wet season and shallow water dry season) of these provinces extend to about 391,580 hectares in cultural hydromorphic soils. The soil types brown hydromorphic soils, coastal grey hydromorphic and basic lithosols are not found in these provinces (Table 2.30).

The total extent of the most suitable soils (cultural hydromorphics, alluvial lithosols, red-yellow podzols, lacustrine alluvial soils and regurs) and the area under four rice ecosystems in the four provinces was analysed. It shows that 85% of the suitable soils are under rice ecosystems and there is a possibility of high productivity in these provinces (Table 2.31 and 2.32).

The current mapping exercise was derived from the information on yield and spread alone. However, the ideal areas for paddy cultivation can be derived if we have information on other parameters, such as water availability, topography, temperature and type of land cover. For policy purposes it is also important to conduct a ground truthing exercise and field survey in order to integrate other parameters, such as market and extension requirements.

A strategy recommendation is to shift two thirds of cultivated land to HYV varieties in these provinces. These four provinces with low yields and large areas have good soils suitable for paddy cultivation. However it should be noted that there are 4 types of rice ecosystems: rainfed, deep water, flood plain and uplands.

CHAPTER - 3

Food Access

CHAPTER 3

Section A

Food and Livelihood Access

Food access is a function of purchasing power. Purchasing power depends upon the income earned and prevailing food prices. Income earning capacity is related to access to productive resources, such as land, buildings and equipment. Human resources, such as education, skills, play an important part. Access to resources will have to be equitable to enable everyone to enjoy a minimum standard of living.

In Cambodia, inflation has remained relatively low since 1999. Only in 2004, prices seem to have increased. Inflation is expected be higher in the current year. The national average population growth rate stands at about 1.8% per annum. However, while urban areas have a very low growth rate of 1.5%, some provinces have growth rates as high as 5%. The population growth rates in the mid-nineties were higher, above 2 percent. Cambodia seems to have experienced a high population growth rate compared to many Southeast Asian countries. The high population growth rate was due to increased birth rates and the repatriation of the population from other countries.

The increase in population has put pressure on economic resources, including land, forest and water, as well as the need for infrastructure, such as roads, electricity and communications. The need for providing safety nets to the poor has also increased. In addition, with the impact of liberalisation and globalisation, influential and wealthy corporations and individuals may corner these resources, leaving very little for the rural population. This is likely to accentuate the poverty situation. Hence, the problems of food and livelihood access need to be viewed against the background of the increase in population, competition from abroad, and the possible increase of the gap between rich and poor.

Cambodia's population in rural areas depends on land and land-based activities. People derive their livelihoods from food production and food-related activities, and will continue to do so until such time that they are engaged in activities other than agriculture. The occupational distribution of the country shows that the country is predominantly agricultural (Table 3.1).

This chapter has three sections. The first section deals with the access to livelihoods and related issues. The state of the economy, levels of poverty and

Table 3.1 - Occupational Distribution

No	Occupational Category	% of Workers
1	% of Farmers	70.66
2	% of Fishermen	2.91
3	% of Traders	10.79
4	% of Government Employees	2.45
5	% of Others	13.19

Source: EIC, Economic Watch of Cambodia 2004

unemployment, levels of education, types of employment, as well as access to land resources and natural resources are also studied in detail in this section. The second section is on correlates of poverty at the provincial and household levels. This section attempts to understand the causes of poverty at the provincial and household levels with the help of secondary data and some household-level data. The third section is devoted to gender concerns in Cambodia.

3.1 Growth in Gross Domestic Product

Gross Domestic Product (GDP) growth is the starting point for a study of food and livelihood access. The growth in GDP is ideally expected to bring about an increase in the incomes of all sections of the population and enhance their standard of living. However, in some cases, the GDP growth is quite divorced from overall welfare and gets concentrated only in some sectors of the economy. A large number of people are left untouched by the growth process and remain at the periphery of the economy. Per capita productivity growth sometimes becomes concentrated only in the commercialised sectors and does not spread to the household enterprise sector (including agriculture). This happens in countries with a large subsistence agricultural sector.

Table 3.2 - Cambodia's Real GDP Growth (% at constant prices)

Sector	2001	2002	2003	2004	2005p
Agriculture	2.60	-0.90	8.20	-4.20	4.10
Paddy	4.50	-8.50	26.90	-11.90	7.50
Industry	11.10	10.40	9.60	15.60	0.60
Garments	29.60	14.30	13.40	25.60	-1.30
Services	5.40	7.40	2.90	9.10	5.60
Tourism	12.30	10.50	-5.30	21.80	9.70
Total GDP	5.70	5.50	5.30	7.00	3.50

Source: EIC, Cambodia Economic Watch
p: Projection for 2004-2005

Overall, real GDP growth in Cambodia has been quite impressive since 2000. The annual compound growth rate in real terms at 2000 prices was 5.7% in 2001 and reached a peak of 7% in 2004. Agricultural growth was only 2.6% in 2001. It is expected to grow to 4.1% in value terms in 2005 (Table 3.2).

As observed in the previous chapter, production growth in agriculture was significant in tonnage terms. However, in value terms the growth was much more subdued and even turned negative. Even though paddy production increased in tonnage terms, it declined in value terms (Table 3.3). This has resulted in declining incomes for farmers.

Farmers constitute more than 70% of the total workforce. Compared to this, the share of agriculture in GDP is only 30%. The sector's worker productivity is the lowest at US $332 in 2000 and it rose to only US $345 in 2003. The decline in the agricultural sector GDP could also be due to a slump in the international prices of paddy, rubber and other commodities. Thus, it is clear that the GDP growth did not much benefit workers in agriculture. It is not surprising that poverty is high in this sector and special efforts are needed to reduce poverty in rural areas.

3.2 Poverty, Employment and Unemployment

3.2.1 Poverty

Poverty is multidimensional in nature. It is more than mere income and consumption. There is often a lack of infrastructure, lack of skills for employment, lack of health facilities and lack of good governance that could provide an appropriate enabling environment and safety nets. For the purpose of measurement, expenditure/ income that could purchase the minimum requirements of food (specified in terms of calories), and other essential items, are considered.

Several methods have been in use to assess poverty. Some are quantitative methods. The headcount ratio is a popular quantitative measure that provides the percentage of people living below a norm defined as the poverty line. Other quantitative measures of poverty are the poverty gap and poverty severity, which bring

Table 3.3 - Production of Agriculture Sectors (% increase, 2000 prices)

	2001 (%)	2002 (%)	2003e (%)	2004p (%)	2005p (%)
Paddy	4.50	-8.70	26.90	-11.90	7.50
Other Crops	8.00	8.50	7.40	5.40	5.30
Livestock	-1.80	1.80	5.20	1.20	2.20
Fishery	4.60	3.10	-3.60	-7.40	1.10
Rubber & Forestry	-19.80	-30.20	-2.10	-2.70	-0.40
Total Agriculture	**2.60**	**-0.90**	**8.20**	**-4.20**	**4.10**

Source: EIC, compiled from the database of the Ministry of Agriculture for 2001-2003, and model projection for 2004-2005.

out the structure of poverty. Qualitative methods assess poverty through other techniques, such as Participatory Rural Appraisal (PRA)[59].

I. Quantitative Methods (Survey and Estimation)

a. Headcount Ratio of Poverty

The headcount poverty rate refers to the proportion of the population living below the poverty line. A value of consumption is chosen as a poverty line, in this case, those consuming less than 2,100 kcal, plus a small allowance for essential non-food expenses. However, the headcount poverty rate has an important weakness as it does not provide information on how far the poor fall below the poverty line.

In the CSES 1997, the poverty rate was calculated at the national level. Although the food poverty line was defined in calorie terms, it was derived from consumption data in value terms, using a reference food basket amounting to 2,100 kcal. Thus, there was no direct determination of the number of people consuming food in quantity terms below, or above, that level. Moreover, the derived poverty line was redefined to ensure comparability with the publicised national benchmark rate of 36.1%. As a result, the poverty line in terms of daily per capita consumption arrived at was 1,629 Riels for Phnom Penh, 1,214 Riels for other urban areas and 1,036 Riels for rural areas. The headcount ratio gives the percentage of the population spending less than this amount in 1998 (Table 3.4 and Appendix 3.1).[60]

Furthermore, the World Food Programme combined CSES 1997 data, the 1998 Population Census and GIS data to estimate the number of poor at the commune level, using the small-area estimation method developed by the World Bank. The estimation was made at the commune level and consolidated at the province level.

b. Poverty Gap or Intensity or Depth of Poverty

The poverty gap tells us how far off people are from the poverty line. This measure reveals the average amount of resources per capita needed to bring all the poor to the level of the poverty line. However, transfers involve leakages and administrative costs, which are not included. Hence, the value of the poverty gap may be interpreted as the minimum amount of income needed to bring them to the poverty line. Often the actual cost of eliminating poverty is a multiple of the poverty gap (Table 3.5).

c. Severity of Poverty or Inequality of Poverty

Severity or inequality of poverty among the poor is measured by attaching a higher weight to the individuals

[59]Chambers, Robert "Rural Appraisals: Rapid Relaxed and Participatory" University of Sussex, 1992.

Table 3.4 - Poverty and Unemployment

		1	2	3	4
No	Province	Poverty Rate	Total Unemployment Rate	Male Unemployment Rate	Female Unemployment Rate
1	Banteay Meanchey	40.88	8.00	6.30	9.70
2	Battambang	26.41	8.00	6.80	9.30
3	Kampong Cham	12.07	4.30	3.90	4.60
4	Kampong Chhnang	44.60	3.10	2.90	3.20
5	Kampong Speu	18.18	2.80	2.90	2.70
6	Kampong Thom	29.07	8.20	6.40	9.90
7	Kampot	18.67	3.70	3.60	3.80
8	Kandal	18.40	4.90	4.60	5.30
9	Koh Kong	8.16	9.30	7.40	12.50
10	Kratie	38.59	6.90	6.30	7.60
11	Kep	48.97	2.00	2.20	1.90
12	Pailin	97.24	5.00	4.60	5.70
13	Sihanoukville	34.12	8.30	6.50	10.80
14	Mondul Kiri	19.87	7.30	7.30	7.30
15	Oddar Meanchey	39.05	4.50	3.40	5.70
16	Phnom Penh	11.92	12.60	8.90	17.00
17	Pursat	40.74	3.50	3.40	3.50
18	Preah Vihear	29.06	2.60	2.60	2.60
19	Prey Veng	53.14	3.00	3.00	2.90
20	Ratanak Kiri	8.81	3.00	3.00	3.00
21	Siemreap	53.73	4.60	3.90	5.30
22	Stung Treng	16.37	3.30	3.20	3.40
23	Svay Rieng	43.29	2.10	2.10	2.10
24	Takeo	15.22	3.50	3.30	3.70

There are other measures of poverty that bring out the structure of poverty.
Source: Col.1 Estimation of Poverty Rates at Commune Level in Cambodia, October 2002, Ministry of Planning and World Food Programme.
Col. 2, 3 & 4, General Population Census of Cambodia, 1998.

who are further away from the poverty line. This index is sensitive to the distribution of living standards among the poor. The numerical value of the index, per se, has no intuitive interpretation (Appendix 3.2)[61]

There are often problems with quantitative poverty measures. First, if the investigators are not well trained, they may not obtain correct information. Second, the small area estimation and sampling procedures have a certain margin of error. Whenever sampling errors are high, the estimates are less reliable.

Poverty Status

About 36% of Cambodia's population was estimated as living below the poverty line in 1998. Cambodia was ranked 130 in the Human Development Index. There is a wide variation in poverty levels across the provinces as per the estimates. Koh Kong and Ratanak Kiri showed a poverty rate of around 8%. The capital city Phnom Penh had a low poverty rate at 11.9%. Eight provinces showed poverty rates less than 20%: Kampong Cham, Kampong Speu, Kampot, Kandal, Koh Kong, Mondul Kiri, Stung Treng and Takeo. The provinces of Pailin, Kampong Chhnang, Prey Veng, and Siemreap seemed to experience higher poverty levels.

In and around the Tonle Sap Lake, provinces including Kampong Thom and Battambang had lower poverty, around 26%, but Pursat and Banteay Meanchey seemed to have a poverty rate around 40%. The provinces in the plains did not show a high poverty rate, except Svay Rieng and Prey Veng (43.49% and 53.14%). These two provinces faced problems of droughts and low yields of paddy. Prey Veng is also prone to frequent floods. The coastal regions showed a moderately low poverty rate although Kep showed a high level of poverty at 48.97%. The plateau and mountain regions showed a moderately low level of poverty, under 40%; the only exception was the municipality of Pailin, which had the highest poverty rate in the whole of Cambodia at 97.24% (Map 3.1).

Looking at the poverty rate, poverty gap and poverty inequality together reveals that Pailin was the worst off. In reality, Pailin town is considered a non-poor area. Besides, the standard error for these estimates was very high. The poor in Pailin accounted for only 0.2% of poor in the country and 0.06% of the total population. This discrepancy is attributed to the fact that a substantial part of Pailin was not covered in CSES 1997. The opinions of chiefs were probably used while gathering information. Hence, this result must be viewed with some scepticism.

For the remaining provinces, Prey Veng, Siemreap and Kep were characterised as having high levels of poverty, poverty gap as well as poverty inequality. Prey Veng also accounted for 16% of the poor. Though the poor in Battambang accounted for 14% of its total population, the inequality in poverty was not very high. Koh Kong, followed closely by Ratanak Kiri, seemed to be better off. The intensity, depth and severity of poverty were the least here. Kampong Cham also had a very low value for inequality in poverty.

The above measures provide some useful directions for a poverty alleviation policy. For example, in a province like Prey Veng, where the inequality in poverty is high, poverty reduction programmes should specifically identify and target the needy. Otherwise, the programme will be in danger of catering to the non-poor. However, in a province like Stung Treng, there is not much inequality within the poor. In this case, the policy may be that of a self-targeting type of intervention, such as a food-for-work programme, that would automatically exclude the non-poor.

II. Qualitative Measures

A qualitative method of 'Participatory Poverty Assessment (PPA)' was adopted in 2001 by the Asian Development Bank to assess the nature of poverty. This method directly involved the people affected by poverty, who were interviewed and their own assessment taken. The PPA uses semi-structured interviewing and the

[60] The Appendix A3.1 gives the method of deriving the poverty line in Cambodia.

[61] The appendix A3.2 gives the method adopted for calculating these three poverty measures.

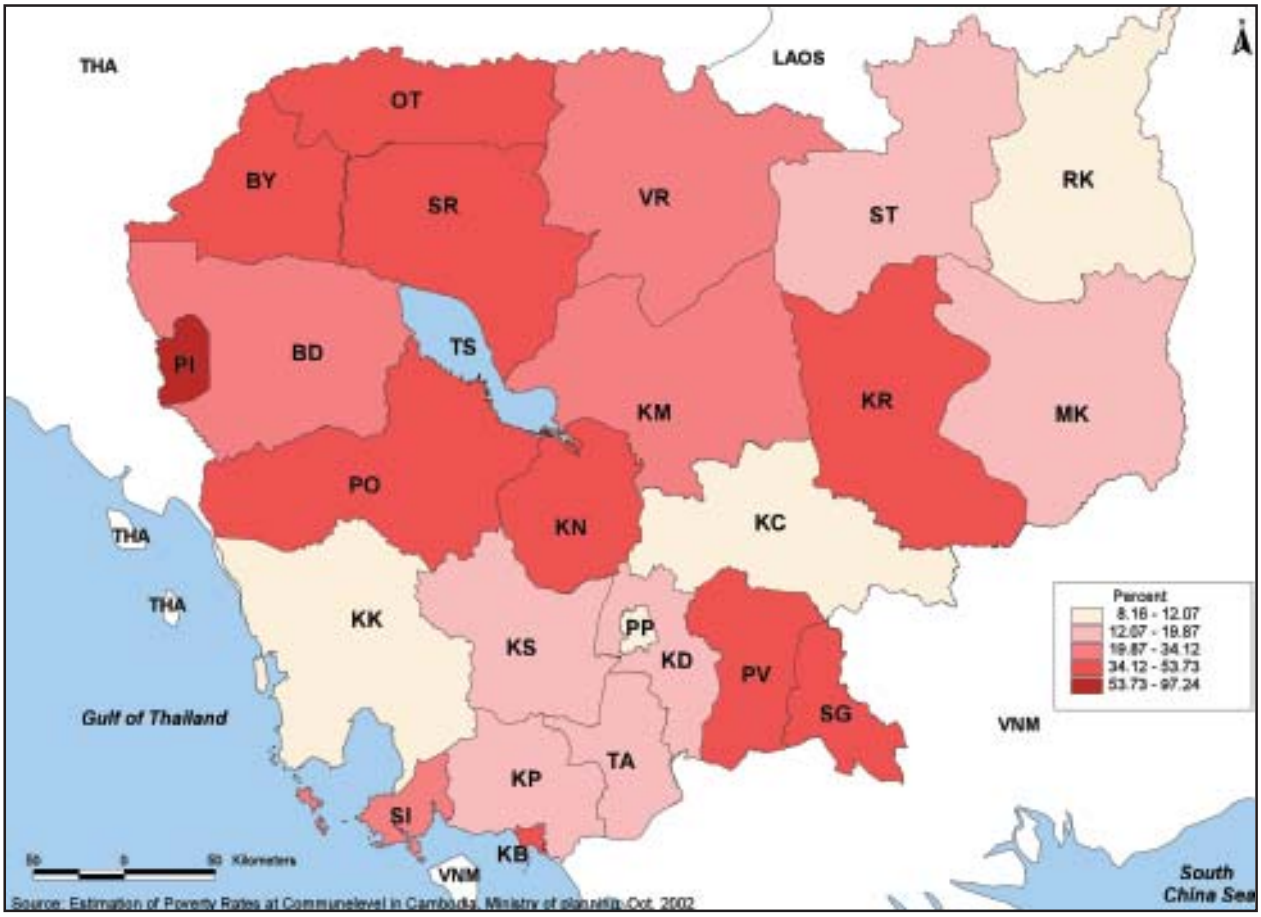
Table 3.5 - Estimates of Poverty Measures by Province

No		Province	Poverty Rate	Poverty Gap	Poverty Severity	% of Total Population	Poverty Share	Est. No.of Poor People
1	p	Banteay Meanchey	40.88	12.79	5.63	5.09	7.55	228.80
			(2.79)	(1.23)	(0.65)			
2	p	Battambang	26.41	7.34	2.93	6.84	6.55	198.70
			(1.68)	(0.70)	(0.36)			
3	p	Kampong Cham	12.07	3.06	1.14	14.33	6.27	190.10
			(1.71)	(0.62)	(0.32)			
4	p	Kampong Chhnang	44.60	12.54	4.97	3.67	5.93	179.90
			(2.43)	(1.01)	(0.50)			
5	p	Kampong Speu	18.18	4.26	1.52	5.27	3.47	105.30
			(2.28)	(0.77)	(0.35)			
6	p	Kampong Thom	29.07	7.89	3.11	4.97	5.24	158.90
			(2.22)	(0.91)	(0.47)			
7	p	Kampot	18.67	4.68	1.72	4.74	3.21	97.30
			(2.42)	(0.95)	(0.48)			
8	p	Kandal	18.40	4.62	1.72	9.51	6.34	192.30
			(2.01)	(0.74)	(0.37)			
9	p	Koh Kong	8.16	2.52	1.14	0.97	0.29	8.70
			(1.28)	(0.56)	(0.33)			
10	p	Kratie	38.59	11.68	4.94	2.31	3.23	97.80
			(2.44)	(1.03)	(0.57)			
11	m	Kep	48.97	17.67	8.79	0.18	0.32	9.60
			(5.17)	(2.92)	(1.88)			
12	m	Pailin*	97.24	61.89	42.43	0.06	0.20	6.00
			(2.26)	(6.84)	(7.46)			
13	m	Sihanoukville	34.12	10.67	4.81	1.34	1.66	50.40
			(2.56)	(1.15)	(0.68)			
14	p	Mondul Kiri	19.87	5.60	2.29	0.28	0.20	6.20
			(5.23)	(1.85)	(0.88)			
15	p	Oddar Meanchey*	39.05	13.55	6.26	0.57	0.81	24.50
			(3.01)	(1.68)	(1.01)			
16	m	Phnom Penh	11.92	2.88	1.16	8.35	3.61	109.40
			(1.19)	(0.36)	(0.16)			
17	p	Pursat	40.74	11.75	4.79	3.13	4.63	140.20
			(2.50)	(1.01)	(0.50)			
18	p	Preah Vihear*	29.06	7.34	2.72	1.03	1.08	32.90
			(4.12)	(1.41)	(0.60)			
19	p	Prey Veng	53.14	15.85	6.51	8.45	16.28	493.60
			(1.84)	(0.94)	(0.52)			
20	p	Ratanak Kiri	8.81	2.86	1.41	0.83	0.27	8.10
			(2.52)	(0.70)	(0.36)			
21	p	Siemreap	53.73	19.13	9.05	6.04	11.77	356.80
			(2.03)	(1.17)	(0.74)			
22	p	Stung Treng	16.37	3.85	1.42	0.70	0.42	12.60
			(2.75)	(0.75)	(0.31)			
23	p	Svay Rieng	43.49	11.81	4.62	4.30	6.78	205.50
			(3.21)	(1.26)	(0.62)			
24	p	Takeo	15.22	4.29	1.92	7.05	3.89	117.90

Note: The figures in brackets are standard errors. All the figures except no. of poor people are expressed as a percentage. No. of poor people is expressed in thousands. Poverty share is the ratio of the number of poor people in the province to the total number of poor people in the country. The provinces marked with an asterisk are completely excluded from the sampling frame of CSES 1997.

Source: Estimation of Poverty Rates at Commune Level in Cambodia, October 2002, Ministry of Planning and World Food Programme.

Map 3.1 - POVERTY RATE



sample is purposive. The PPA methodology consists of focus-group discussion, listing, scoring ranking, prioritising, cause-effect solution analysis and individual case studies. There are some drawbacks in the PPA method. A correct indication of the poverty situation may or may not be obtained. Sometimes, people are unwilling to help in the assessment, either due to lack of interest or fear of suppression. Sometimes, vulnerable groups do not tell the truth. Much depends upon the skill of the person undertaking the PPA. However, the qualitative portion of the PPA can provide the ethnographic flesh that a quantitative survey lacks.

The 2001 ADB PPA study showed that not having enough to eat throughout the year was a major cause of poverty. Diversification of income and levels of poverty were not related across the provinces. There were fears of dominance by the richer sections and of losing land and identity. The high dependency ratio of young children and the migration of the adult members of the family kept the household in abject poverty. Lack of education was identified as one of the causes of poverty, as people were unable to take advantage of employment opportunities available in non-agricultural sectors. Landmine-affected lands were of concern to people. Disasters that affect production, the theft of draught animals, debt related to illness, gambling, alcoholism and death were some of the other identified causes of poverty.

It was also mentioned that internally displaced people and people from refugee camps in Thailand were

sometimes settled in the mine-affected lands close to the border. It was felt by some sections of the population that things were worse than before. Others felt that after foreigners settled in Cambodia, land availability had declined. Social relations in Cambodian society seem to have weakened the intra-household cooperation and support system. However, family bonds appeared to be strong in the ethnic minorities, such as Vietnamese and Chams (Muslims).

In addition, the land redistribution of 1989 benefited some lowland Khmer communities with large households. Upland ethnic minorities retained their communal ownership of land. The Khmer kinship system allows equal share to sons and daughters. Lowland communities complained about the confiscation of land by settlers across the borders. The issue of land ownership initially drew the attention of the upland people, but the restriction of access for use is what angered them most. Some felt that the situation had become worse in 2001. In Svay Rieng, the problem was not land but the lack of capital to clear the land and use it.

The final observations of the PPA were not very dramatic. It brought out many of the same issues, familiar to long-time observers of Cambodia, as other surveys and sociological descriptions.

3.2.2 Labour Force Participation and Unemployment [62]

1. Labour Force Participation Rates

Cambodia is sparsely populated. However, the population growth rate in recent years has been high, probably due to migration and high birth rates. The labour force participation rate is the proportion of the economically active population to the total working age population[63]. The labour force participation rate increased from 55.5% in 1998 to 65.5% in 2004. The labour participation rate appear high for Cambodia, compared to the rate of 40% for the rest of Southeast Asia.

As per the 2004 CIPS, the labour force participation in the age groups of 7-14 years was high in Cambodia. About 22.4% of children in the age group of 10-14 and 4.8% of the children in the age group of 7-9 were economically active in the country as a whole. For the age group of 10-14, the labour participation rate was very high in rural areas at 24.5%. About 25.2% of rural male children and 23.8% of rural female children were economically active. The labour force participation of Cambodian rural children is high since a number are unpaid family workers. The involvement of children in family enterprise activities, such as cultivation, livestock rearing, fishing and forestry, could explain their labour force participation. In rural areas it is interesting to note that a slightly larger percentage of boys are economically active than girls. Girls are involved in house work, such as cooking, washing, collecting fuel wood, that does not count as being economically active. Boys in the rural areas may be introduced to the family enterprise early in life.

By contrast, in urban Cambodia, the percentage of economically active children was lower, at about 9.4%, for the country as a whole. Fewer boys than girls were in the labour force in contrast to rural areas. About 8.3% of boys and 10.6% of the girls in the age group of 10-14 were economically active in the urban areas of Cambodia. Some of them probably qualified as child labour if they were employed full time in the urban service sector.

If we compare the labour participation of children with school enrolments of children in the same age groups, we obtain an indication of the deprivation of education. While 4.8% of children in the age group of 7-9 were economically active, about 81% in this age group were enrolled in school. This would mean that some children were probably deprived of school although they may not have worked long enough hours to have qualified as child labour.

[62] Royal Government of Cambodia, Ministry of Planning, National Institute of Statistics, "Cambodia Inter-Censal Population Survey- 2004", General report, Sponsored by UNFPA November 2004.

[63] The labour force or economically active population consists of the employed as well as unemployed and underemployed. The labour participation rate consists of the proportion of workers to the total working age population.

Table 3.6 - Age-Specific Labour Force Participation Rate by Sex and Urban-rural Residence

		Total			Urban			Rural	
Age Group	Both Sexes	Males	Females	Both Sexes	Males	Females	Both Sexes	Males	Females
Total 7+	65.50	66.40	64.60	56.50	60.30	52.90	67.10	67.50	66.80
7-9	4.80	5.10	4.40	1.00	0.90	1.10	5.30	5.70	4.90
10-14	22.40	22.80	22.00	9.40	8.30	10.60	24.50	25.20	23.80
15-24	75.70	73.70	77.60	58.40	57.30	59.40	79.20	76.90	81.40
25-34	94.20	98.50	90.30	85.30	96.10	75.30	96.00	99.00	93.20
35-44	95.00	99.30	91.40	87.50	98.60	77.60	96.50	99.50	94.00
45-54	93.60	98.30	90.50	84.90	96.20	76.30	95.40	98.70	93.10
55-64	83.90	93.70	76.70	69.60	82.30	60.70	86.20	95.50	79.40
65+	43.40	60.60	31.80	30.90	50.20	18.00	45.30	62.10	33.90

Source: Cambodia Inter-Censal Population Survey 2004, General Report.

In the age group of 10-14, there seems to be an overlap between school enrolment and labour force participation. While about 90% of children were enrolled in school, 22.4% were in the labour force. It may mean that some of them were in and out of school depending upon work availability or they worked after school hours regularly. For girls in the age group 10-14, the school enrolment was 89% and labour force participation was 22%. For boys in the same age group, the school enrolment was 91% and labour force participation was about 22.8%. Unfortunately, we do not have the rural-urban break down of school enrolment for 2004. However, this group, as a whole, cannot be termed as child labour. Indeed, unless it is proved that such work is for long hours along with school and deprives the child from growing up as a normal child, child workers in family enterprises are not categorised as child labour. Alternately, unless it is proved that the work is depriving the child from attending school, working children are not considered as child labour[64] (Table 3.6).

In the age groups of 15-24 there were more women than men in the labour force, both in urban and rural areas. This could be due to the family preference of sending young men for higher education and sending young girls to work. About 60% of urban women and 81% of the rural women were in the labour force in this age group, while only 57% of urban men and about 77% of rural men joined the labour force in this age group. However, at the higher age groups there were more men than women. Women's withdrawal from work at all ages and particularly in higher age groups contributes to the lower work participation rate of women in urban areas. Women seem to enter the labour force and exit from the labour force at a lower age compared with men.

The labour force participation rates of the elderly population in the age groups of sixty-five and above were also high in both urban and rural areas. One-third of the elderly population was economically active. Due

[64] International Labour Organization (ILO), "Elimination of Child Labour", http://www.ilo.ru/ecl/def.htn.

Table 3.7 - Labour Force Participation Rates, 1998

No	Province	Labour Force Participation Rate		
		Both Sexes	Males	Females
1	Banteay Meanchey	55.20	57.70	52.90
2	Battambang	50.70	54.70	46.90
3	Kampong Cham	55.90	57.10	54.80
4	Kampong Chhnang	59.10	57.80	60.30
5	Kampong Speu	57.00	54.20	59.50
6	Kampong Thom	51.90	54.90	49.20
7	Kampot	56.80	54.90	58.40
8	Kandal	55.10	55.60	54.60
9	Koh Kong	53.10	66.40	39.10
10	Kratie	54.60	59.70	49.70
11	Mondul Kiri	62.90	67.10	58.60
12	Phnom Penh	49.10	56.30	42.50
13	Preah Vihear	61.90	63.00	60.90
14	Prey Veng	59.60	55.90	62.80
15	Pursat	55.60	54.40	56.60
16	Ratanak Kiri	68.20	69.00	67.30
17	Siemreap	58.20	59.10	57.40
18	Sihanoukville	49.20	57.80	41.00
19	Stung Treng	63.90	65.20	62.50
20	Svay Rieng	58.10	53.80	61.90
21	Takeo	56.70	54.00	59.00
22	Oddar Meanchey	56.20	59.40	53.00
23	Kep	54.70	55.50	53.90
24	Pailin	60.00	70.40	47.30
	Cambodia	**55.50**	**56.50**	**54.60**

Source: Population Census of Cambodia, 1998.

to the high involvement of unpaid family workers in the family enterprises, the labour force participation rates for Cambodia appear to be unusually high.

2. Provincial Labour Force Participation Rates

It was observed from the 1998 data for Cambodia that the labour force participation was 56.5% among males and 54.6% for females. The labour force participation rate was the highest in provinces like Ratanak Kiri (68.2%), Stung Treng (63.9%), Preah Vihear (61.9%), Pailin (60%) and Mondul Kiri (62.9%). Other provinces, such as Bantey Meanchey, Kampong Cham, Kampong Chhnang, Kampong Speu, Kampot, Kandal, Koh Kong, Kratie, Prey Veng, Pursat, Siemreap, Svay Rieng, Takeo, Oddar Meanchey and Kep, also had a high rate of labour participation ranging from 50% to 60%.

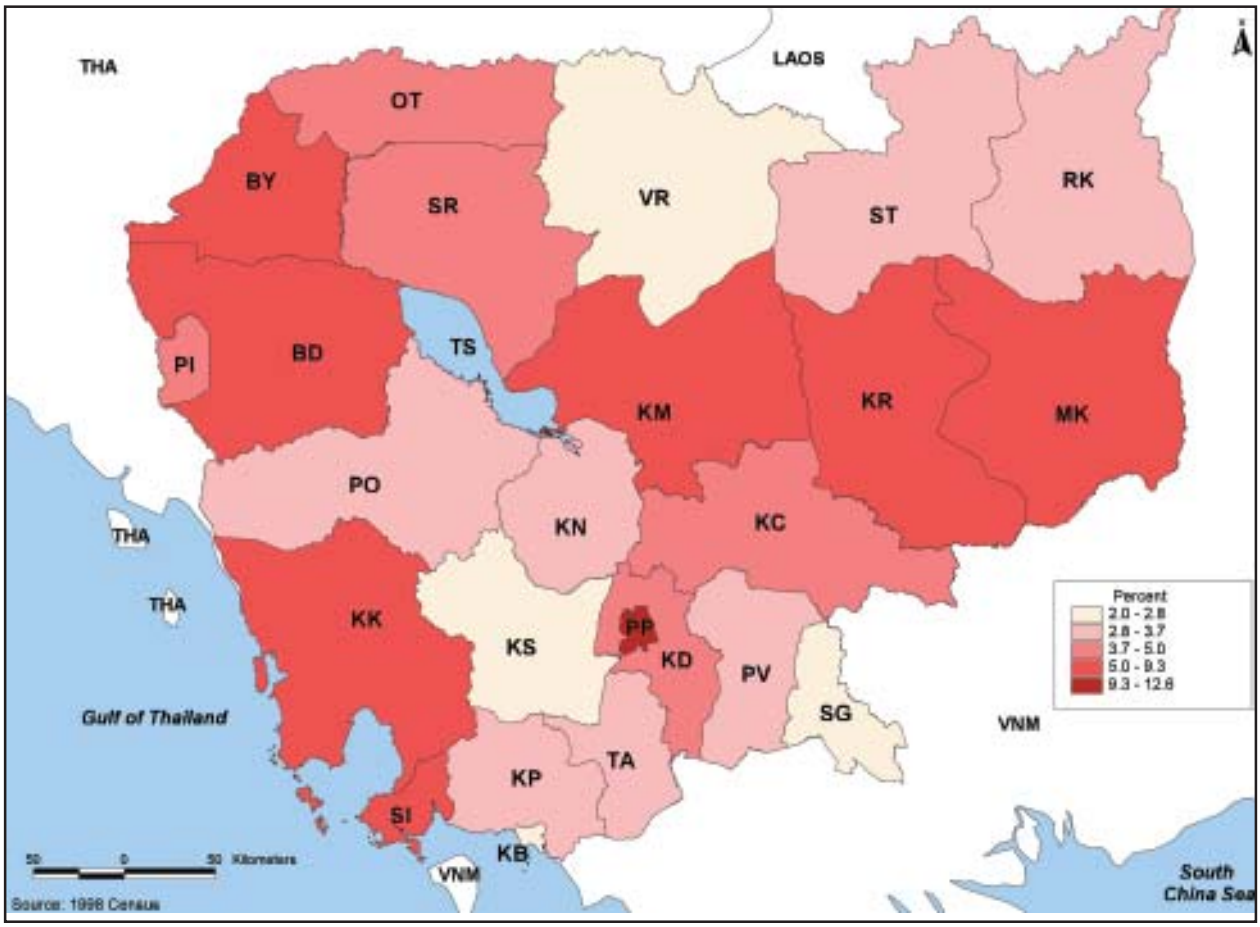
The female labour participation rate was highest in Ratanak Kiri (67.3%) where the male participation was also the highest (69%). In certain provinces like Kampong Chhnang, Kampong Speu, Kampot, Prey Veng, Pursat, Svay Rieng and Takeo, the female participation rates were higher than the male participation rates (Table 3.7). The reasons will be examined in the section on gender concerns.

3. Unemployment

As in other developing countries dependent on agriculture, unemployment rates have been low in Cambodia at about 4.7% for males and 5.9% for females in 1998. Female unemployment appears to be higher than the male unemployment rate. The unemployment rate has been defined as the percentage of unemployed among the economically active population. The unemployment rate increased from 5.3% in 1998 to 7.1% in 2004.

Provincial unemployment rates in 1998 showed variations across the country. The province with the largest percentage of unemployment was Phnom Penh with 12.6%. One reason for this may be that there are a large number of educated people in this city and finding jobs to suit their qualifications and requirements was difficult. A large number of people might have chosen not to work because of low wages. The other provinces that had a large rate of unemployment in 1998 were

Map 3.2 - UNEMPLOYMENT RATE



Kampong Thom, Koh Kong, Beanteay Meanchey, Battambang and Preah Vihear with 8.2%, 9.3%, 8%, 8% and 8.3%, respectively. In almost all the provinces, it appears that the female unemployment rate was greater than the male unemployment rate. The provinces with the lowest rate of unemployment include Preah Vihear, Kep, and Svay Rieng, with 2.6%, 2% and 2.1%, respectively. The unemployment rate of the other provinces was in the range of 3% to 8%.[65] (Map 3.2).

3.2.3 Employment and Literacy Levels

1. Employment

It has been observed that 74% of the employed were in the primary sector, consisting of agriculture, hunting, forestry and fishing. The primary sector population was 77% in 1998. About 7% belonged to the secondary sector, consisting of mining, quarrying, manufacturing, gas, construction, and water supply. About 19% were in the tertiary sector consisting of trade, hotels, transport and business. There has been a welcome shift from the primary to the secondary and tertiary sectors in recent years. The non-agricultural population in the country was 31% in 2004.

2. Occupational Distribution

According to the CIPS 2004, most people in Cambodia were either own-account workers (41%) or unpaid family workers (45.7%). The paid employees accounted for 12.9% of the total workforce. The

[65]Refer to Table no. 3.4

Table 3.8 - Percentage Distribution of Employed Persons by Main Employment Status

		Employment Status					
Location	Sex	Total	Employer	Paid Employee	Own Account Worker	Unpaid Family Worker	Other
Urban	Both Sexes	100	0.50	30.80	40.70	27.60	0.40
	Male	100	0.60	39.20	43.10	16.60	0.50
	Female	100	0.40	21.9	38.20	39.20	0.30
Rural	Both Sexes	100	0.20	10.20	41.00	48.50	0.10
	Male	100	0.20	13.10	54.90	31.70	0.10
	Female	100	0.20	7.50	28.50	63.70	0.10
Total	Both Sexes	100	0.20	12.90	41.00	45.70	0.20
	Male	100	0.30	16.80	53.10	29.60	0.20
	Female	100	0.20	9.30	29.70	60.70	0.10

Source: Cambodia Inter-Censal Population Survey 2004, General Report.

percentage of employed males was greater than that of females. In the case of unpaid family workers alone, the percentage of employed females was higher. Around 60.7% of the female population were unpaid family workers as compared to the males at 29.6%.

In the urban areas, around 40.7% were own-account workers and 30.8% were paid employees. In the case of unpaid family workers, the percentage of females was also greater than males. Females accounted for 39.2% while the males accounted for 16.6%. In the rural areas, the own-account workers accounted for 41% and the unpaid worker accounted for 48.5% of the total work force. Again, the unpaid female workers accounted for 63.7% of the female workers. The unpaid male workers accounted for only 31.7% of the total male workers (Table 3.8).

The livelihood situation seems to have deteriorated since 1998, mostly due to the inability of the economy to keep pace with the increase in the labour force in all age groups. The relative employment situation of men in 2004 deteriorated compared to 1998. However, the male employment situation is better than that of women overall.

The percentage of unpaid family workers among men increased from about 19.5 percent to 29.6 percent from 1998 to 2004 for the country as a whole. In the rural areas, male unpaid family workers increased from 21.5 percent in 1998 to 31.7 percent in 2004. Male own-account workers declined in rural areas from 64.3 percent in 1998 to 54.9 percent in 2004. Paid employment for rural men remained more or less the same. It was 13.5 percent in 1998 and 13.1 in 2004. The decline in own-account workers in rural areas could be due to the loss of land or the migration of adult men out of rural areas in search of work, leaving only the male children behind as unpaid family workers.

Table 3.9 - Percentage of Employment in Cambodia by Age Group, 2004

	Total			Urban			Rural		
Age Group	Both Sexes	Males	Females	Both Sexes	Males	Females	Both Sexes	Males	Females
Total 7+	60.80	61.30	60.30	52.80	56.90	49.10	62.20	62.10	62.40
7-9	2.10	2.50	1.70	0.40	0.40	0.50	2.40	2.80	1.90
10-14	13.80	13.70	13.80	6.30	5.60	7.10	15.00	15.00	14.90
15-24	68.10	65.00	71.20	51.60	50.00	53.00	71.50	67.90	75.00
25-34	92.00	96.40	88.10	82.30	93.50	71.70	94.00	96.90	91.20
35-44	93.30	98.20	89.20	85.40	97.50	74.60	94.80	98.40	91.90
45-54	91.90	96.90	88.50	82.80	94.60	73.70	93.70	97.40	91.20
55-64	81.80	92.70	73.90	67.60	81.00	58.30	84.20	94.50	76.50
65+	41.10	58.20	29.50	28.70	47.60	16.00	42.90	59.80	31.50

Source: Cambodia Inter-Censal Population Survey 2004, General Report.

The percentage of urban unpaid male workers increased from about 9.3% in 1998 to 16.6% in 2004. Urban own-account workers remained more or less the same at around 43-44%. Urban paid male workers also declined from about 45.2 to 39.2% in 2004. In urban areas, the garment industry mostly employed women. Other opportunities for women did not catch up with the labour force increase.

3. Employment by Age Group

The age group of 35-44 shows the highest percentage of people employed at about 93.3%. In rural areas, the percentage of the employed female population was higher than in urban areas. It comes as no surprise that the percentage of employed males exceeds employed females, in both the rural and the urban areas, in almost all the age groups. As per the CIPS 2004, about 58% of males and 30% of females were still employed in the 65+ age group. Employment among children (10-14 years) was about 14% and was higher in rural areas than in urban areas. In the 15-24 age group, 68.1% were employed in rural areas and 71.5% were employed

Table 3.10 - Literacy Rates in Cambodia, 1998 and 2004

Sex	Location	% of Literate	
		1998	2004
Both Sexes	Total	62.80	74.40
	Urban	75.50	83.50
	Rural	60.30	72.70
Male	Total	71.00	82.10
	Urban	82.10	88.90
	Rural	68.80	80.80
Female	Total	55.40	67.40
	Urban	69.30	78.60
	Rural	52.70	65.30

Source: General Population Census of Cambodia, 1998. Cambodia Inter-Censal Population Survey, 2004.

in urban areas. The difference could be due to students in educational institutions in urban areas (Table 3.9).

4. Literacy and Educational Achievements

Education is the backbone of any economy as it plays the main role in determining livelihoods, living standards of people and also the intellectual capacity of the nation. The adult literacy rate in Cambodia, as per the 1998 Census was 67.3%, with male literacy accounting for 79.5% and female literacy at a low of 57%.[66] The overall literacy rate in 1998 was 62.8%, with male literacy at 71.0% and female literacy at 55.4%. There was an increase in the overall literacy rate in 2004 according to the CIPS. The male literacy rate at the national level increased to 82.1% and the female literacy rates increased to 67.4%, thus the overall literacy rate improved to 74.4%. This is because of an improvement in the literacy rates in the rural areas with the percentage of male literates rising from 68.8% in 1998 to 80.8% in 2004 and an increase of female literacy rates to 65.30% in 2004 from 52.7% in 1998.[67] This has been a remarkable achievement (Table 3.10 and 3.11).

Table 3.11 - Adult Literacy Rates by Sex and Residence in Cambodia

Location	Both Sexes	Male	Female
Cambodia	67.30	79.50	57.00
Urban	79.10	88.30	70.80
Rural	64.90	77.60	54.30

Source: National Institute of Statistics, Ministry of Planning, General Population Census of Cambodia, 1998.

The provinces recording the highest literacy rate in Cambodia according to the 1998 Census were Phnom Penh with an 85% overall literacy rate, followed by more than 70% literacy rates in Svay Rieng, Kandal, Pailin and Battambang. The lowest literacy rate was in

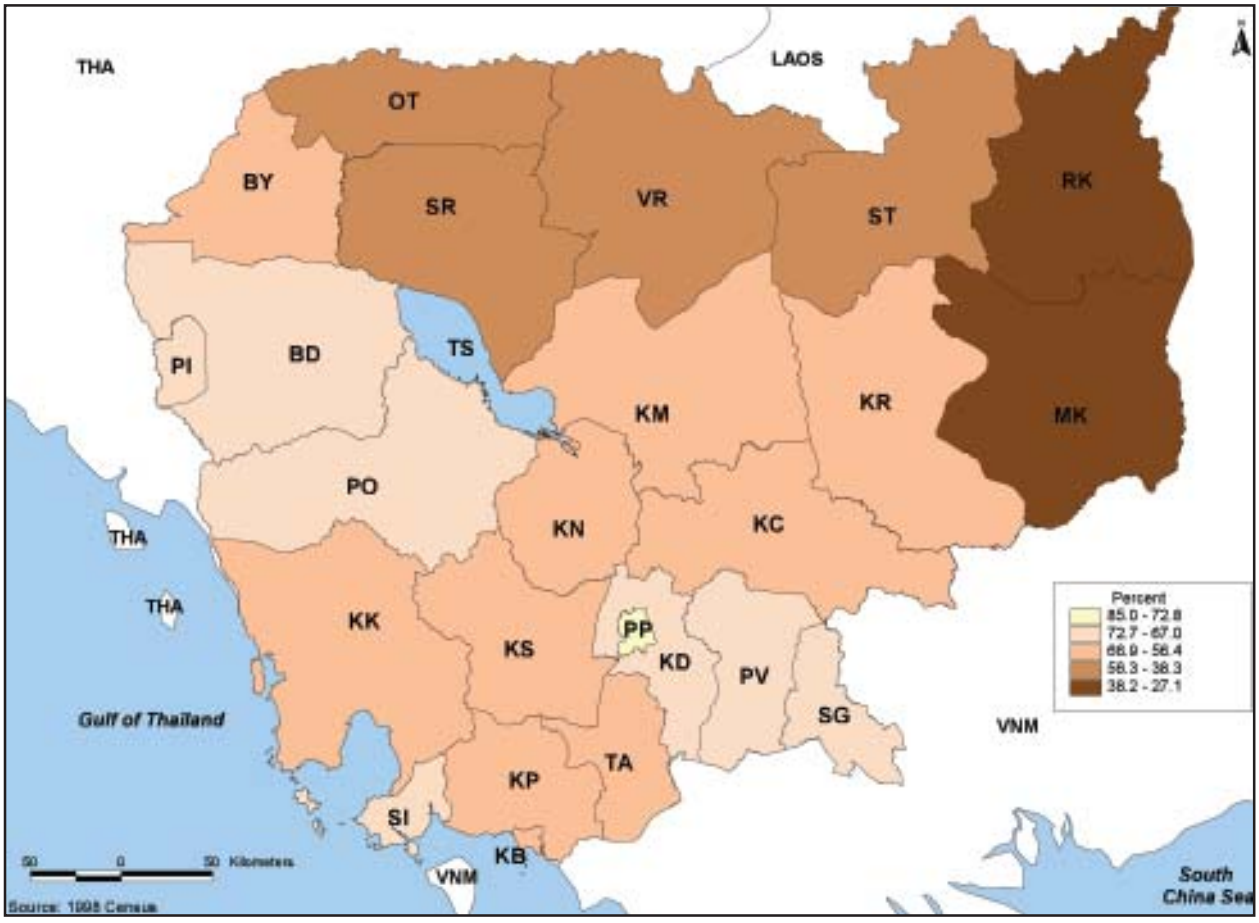
Table 3.12 - Adult Literacy Rates by Sex and by Province, 1998

No	Province	Literacy Rate		
		Both Sexes	Males	Females
1	Banteay Meanchey	66.90	79.40	55.60
2	Battambang	70.80	82.10	60.70
3	Kampong Cham	64.00	76.10	53.70
4	Kampong Chhnang	63.90	76.50	53.70
5	Kampong Speu	64.20	79.20	51.60
6	Kampong Thom	60.40	71.30	51.30
7	Kampot	64.30	78.00	53.00
8	Kandal	72.40	83.70	62.80
9	Koh Kong	62.50	75.40	48.70
10	Kratie	66.80	75.70	58.40
11	Mondul Kiri	38.20	52.40	24.00
12	Phnom Penh	85.00	92.30	78.60
13	Preah Vihear	56.30	67.90	45.20
14	Prey Veng	68.90	83.60	57.30
15	Pursat	70.00	82.50	59.50
16	Ratanak Kiri	27.10	38.90	16.30
17	Siemreap	52.70	63.90	43.10
18	Sihanoukville	70.00	82.80	58.20
19	Stung Treng	54.60	65.40	44.50
20	Svay Rieng	72.20	88.20	59.70
21	Takeo	66.50	81.80	54.00
22	Oddar Meanchey	46.50	62.20	30.70
23	Kep	60.00	74.00	47.80
24	Pailin	72.70	83.80	58.40
	Cambodia	**67.30**	**79.50**	**57.00**

Source: General Population Census of Cambodia, 1998.

[66] Royal Government of Cambodia, National Institute of Statistics, Ministry of Planning, General Population Census of Cambodia, 1998.

Map 3.3 TOTAL LITERACY RATE



Ratanak Kiri, where it was just 27.1%, and Mondol Kiri, with a 38.2% literacy rate.[68] Recent information on literacy at the provincial level was not available (Table 3.12 and Map 3.3 & 3.4).

As far as the educational attainment is concerned, the 1998 Census recorded the highest percentage of primary education attainment in the age groups 25-34 years.[69] The same age group recorded the highest rate of lower secondary education attainment. However, as the educational level rises, the percentage of educational attainment shows a steeply declining trend in all these age groups. This shows that though the people are literate, their level of educational attainment is still low. Also, there is neglect of the female population at the very basic entry level (Table 3.13).

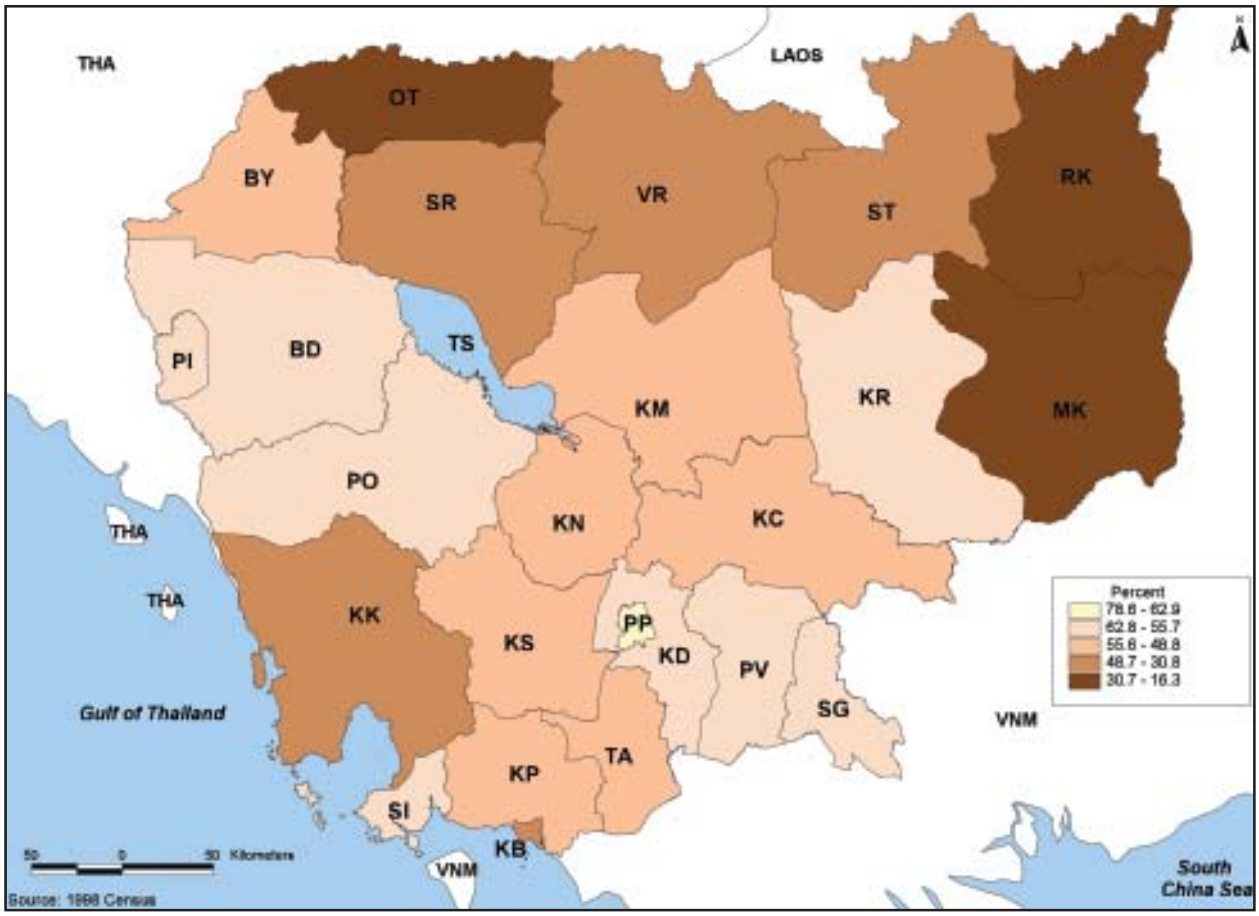
As per the CIPS 2004, 54 % of the literate population had not completed primary education. Only about 24% completed primary education. About 16% of the literate population achieved secondary education. Those completing higher education beyond secondary were only 1.1%. Female educational attainments were lower. About 63.6% of the literate female population

[67] Royal Government of Cambodia, Ministry of Planning, National Institute of Statistics, "Cambodia Inter-Censal Population Survey- 2004", General Report, Sponsored by UNFPA November 2004.

[68] Royal Government of Cambodia, National Institute of Statistics, Ministry of Planning, General Population Census of Cambodia, 1998

[69] ibid

Map 3.4 - FEMALE LITERACY RATE



did not even complete the primary level. About 20% completed primary level education. Only about 11% of literate women achieved secondary level education. Higher levels of educational achievement was seen only for about 0.5% of literate women and 1.6% of literate men. While the gender gap at the primary education level among the population aged 25 years and above was about 7.8%, the gender gap at the secondary levels was higher and the gender gap increased remarkably for higher education. When the education gap closes, the employment gap also increases between the sexes for the highly educated group, unemployment being higher for females than males.

As per the 1998 Census, the educational attainment was the highest in Phnom Penh, which had the highest percentage of population amongst all other provinces, who had completed their primary (28.1%), lower secondary (17.4%), secondary, and higher education (12.14%). The educational attainment was at its lowest in Preah Vihear, with 76.2% of the population having enrolled but not completed primary education; only about 14.4% completed primary level education. Also, in the same province, just 5.6% completed their lower secondary, and 1.5% completed their secondary education and beyond (Table 3.14, Map 3.5 and 3.6)

3.3 Possession of Land

1. Landlessness

In rural areas, landless people dependent on agriculture possess farming skills and earn income from their

Table 3.13 - Educational Attainment at the National Level

Educational Level	Sex	Age Group					
		of 25+	25-34	35-44	45-54	55-64	65+
Total		100	100	100	100	100	100
None	Both Sexes	2.10	1.10	1.80	2.30	4.80	9.20
	Males	2.00	1.00	1.60	1.90	4.10	8.10
	Females	2.20	1.20	2.00	2.70	6.50	13.80
Primary Not Completed	Both Sexes	56.60	50.40	63.70	57.50	59.00	65.50
	Males	49.00	40.60	56.40	49.30	55.00	64.30
	Females	66.10	61.40	71.50	67.70	69.30	70.10
Primary	Both Sexes	24.70	29.90	19.60	23.00	21.90	16.30
	Males	28.70	34.40	24.00	27.80	25.20	18.10
	Females	19.70	25.00	15.00	17.00	13.60	8.80
Lower Secondary	Both Sexes	11.80	12.50	11.20	12.40	11.10	7.40
	Males	13.90	15.40	13.00	14.50	12.20	7.90
	Females	9.20	9.10	9.30	9.80	8.30	5.60
Secondary and Above	Both Sexes	4.80	6.10	3.70	4.80	3.20	1.60
	Males	6.40	8.60	5.00	6.50	3.50	1.60
	Females	2.80	3.30	2.20	2.80	2.30	1.30

Source: General Population Census of Cambodia, 1998.
Note: Educational levels completed by literate persons aged 25 years and over by urban/rural residence, Cambodia.

labour. However, their income as casual agricultural labour tends to be lower than income from farming. Landless agricultural labour households also occupy the lowest levels of society. In the years of droughts and floods, they suffer more due to lack of work. Landless households among agricultural households were 22.4%, as per the CSES 1999. In rural areas, 15.8% of agricultural households were landless. Landlessness was higher among the female-headed households compared to male-headed households when we consider both urban and rural agricultural households together. It was 28.8% for female-headed households and 20.9% for male-headed households.[70]

Among the provinces, Kratie had the highest level of landlessness at 39.3% followed by Koh Kong at 37.9%. Other rural provinces with high landlessness of more than 25% were Battambang and Pursat. Thus, two out of these four provinces with high landlessness are in the Tonle Sap region, which is predominantly a rice-growing area (Table 3.15).

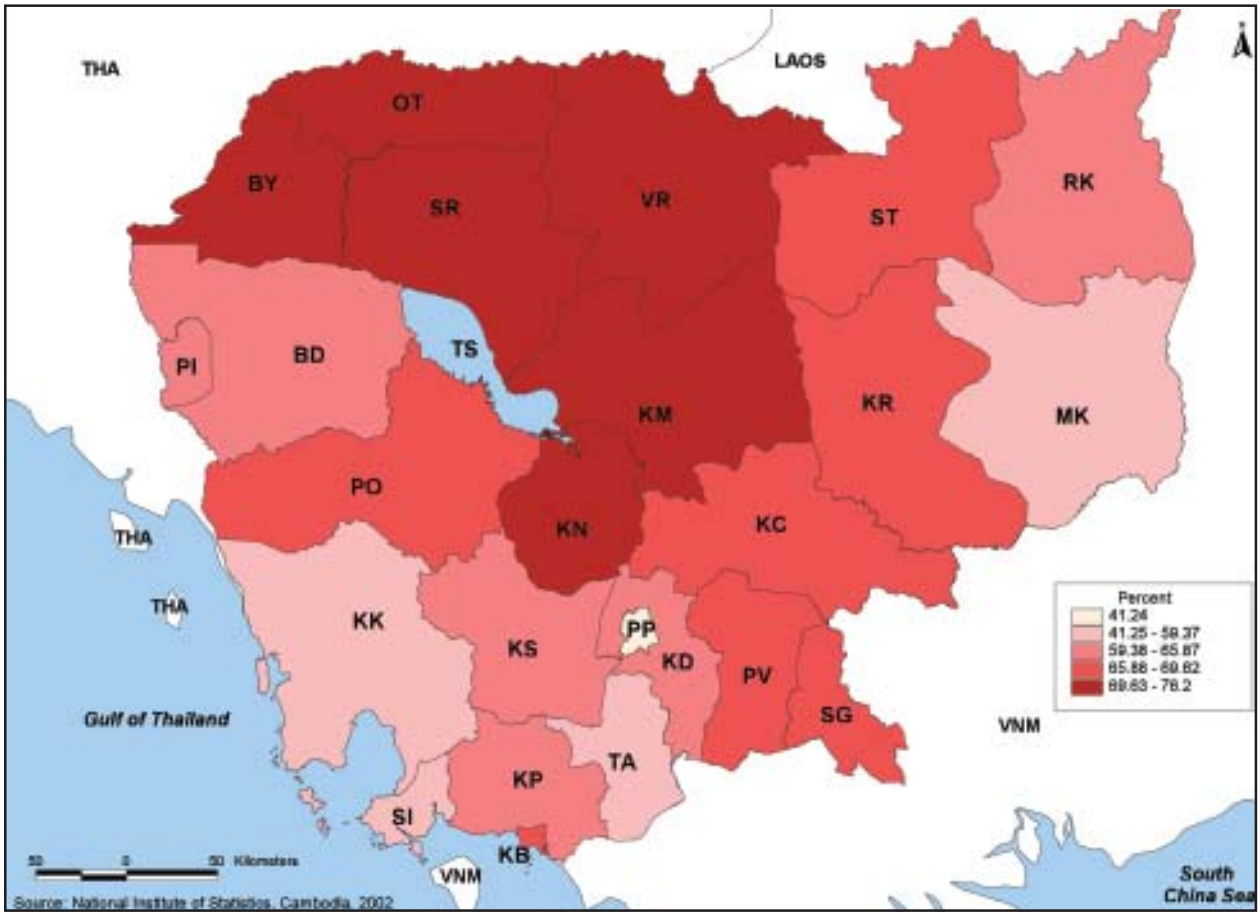
People seem to have lost land in recent years due to indebtedness, arising out of low incomes and low productivity. Other reasons are historical. Conflicts and collectivisation prior to the Paris Agreement, especially during the Khmer Rouge regime, resulted in

Table 3.14 - Provincial Educational Attainment

		Educational Attainment				
No	Province	None	Primary Not Completed	Primary	Lower Secondary	Secondary and Above
1	Banteay Meanchey	1.62	69.88	19.50	7.28	1.73
2	Battambang	1.60	63.41	23.13	8.99	2.87
3	Kampong Cham	2.18	68.81	20.06	7.44	1.50
4	Kampong Chhnang	2.72	69.89	19.49	6.53	1.36
5	Kampong Speu	1.92	65.21	22.47	8.70	1.70
6	Kampong Thom	2.33	70.69	17.96	7.36	1.65
7	Kampot	1.40	65.87	22.11	8.66	1.96
8	Kandal	1.84	61.98	24.05	9.48	2.64
9	Koh Kong	1.97	57.98	26.73	10.17	3.15
10	Kratie	1.69	66.42	21.68	8.60	1.61
11	Mondul Kiri	2.81	56.91	23.67	13.20	3.42
12	Phnom Penh	1.13	41.24	28.10	17.40	12.14
13	Preah Vihear	2.35	76.20	14.35	5.58	1.52
14	Prey Veng	1.79	69.62	20.86	6.49	1.25
15	Pursat	1.30	68.28	19.60	8.80	2.02
16	Ratanak Kiri	3.99	62.93	20.03	10.31	2.75
17	Siemreap	2.55	73.22	16.35	5.95	1.93
18	Sihanoukville	1.06	55.98	27.00	11.85	4.10
19	Stung Treng	1.29	66.25	20.43	9.67	2.37
20	Svay Rieng	1.18	67.04	23.08	7.26	1.44
21	Takeo	1.43	59.37	27.10	10.09	2.00
22	Oddar Meanchey	2.14	73.83	16.75	5.79	1.50
23	Kep	1.37	67.96	22.47	6.70	1.50
24	Pailin	3.36	64.68	20.72	8.85	2.38
	Cambodia	**1.76**	**63.43**	**22.39**	**9.24**	**3.18**

Source: General Population Census of Cambodia, 1998.

Map 3.5 - PERCENTAGE OF POPULATION WITH INCOMPLETE PRIMARY EDUCATIONAL ATTAINMENT



the loss of private rights to land. People left their land and migrated to other locations during the years of unrest. When they came back, land records were not available and there were no community farms. Hence, many lost possession of land. They had therefore to compromise and settle wherever they could.[71]

2. Landholdings

There have been many surveys conducted regarding the average size of agricultural landholdings per household. According to the CSES 1999, the average size was 1.3 hectares in the rural areas. Overall, the average size for rural and urban areas was 1.2 hectares. A more recent survey, (Follow-up 2000), indicates that the average size of the holding was no more than 0.96 hectares.

There seems to be an inverse relationship between population density and average size of the landholding. A higher density of population was associated with smaller holding size. However, Mondul Kiri seems to be an exception. It has a small population and a very large geographical area. However, the agricultural land holding size was small. It is quite the opposite in the lower Mekong provinces.

[70]Sophal Chan, Saravy Tep, and Acharya Sarathi, "Land Tenure in Cambodia", Working paper, Cambodia Development Research Institute, Phnom Penh, 2001.

[71]ibid

Table 3.15 - Agricultural Landlessness by Province (in %)

No		Province	CSES-97 (Rural)	CSES-99 (Rural)	CSES-99 (Total)	LADIT-00 (Rural)
1	p	Banteay Meanchey	13.00	15.80	19.00	12.70
2	p	Battambang	27.00	28.80	36.10	19.50
3	p	Kampong Cham	19.00	14.20	15.90	10.70
4	p	Kampong Chhnang	16.00	14.30	18.00	12.00
5	p	Kampong Speu	6.00	3.50	4.80	10.40
6	p	Kampong Thom	9.00	8.80	10.00	11.00
7	p	Kampot	2.00	5.30	8.00	5.60
8	p	Kandal	17.00	15.90	17.80	15.60
9	p	Koh Kong	50.00	37.90	48.60	24.50
10	p	Kratie	23.00	39.30	37.60	12.10
11	m	Kep			7.60	
12	m	Pailin			0.00	6.50
13	m	Sihanoukville			56.60	
14	p	Mondul Kiri			15.50	
15	p	Oddar Meanchey		4.80	5.40	12.10
16	m	Phnom Penh		74.30	88.20	3.10
17	p	Pursat	13.00	26.20	26.20	13.00
18	p	Preah Vihear		2.40	2.40	
19	p	Prey Veng	7.00	8.90	9.30	5.70
20	p	Ratanak Kiri	3.00	7.90	10.70	
21	p	Siemreap	8.00	8.30	19.50	18.80
22	p	Stung Treng		5.00	24.20	5.60
23	p	Svay Rieng	4.00	4.40	6.50	6.40
24	p	Takeo	3.00	9.30	9.20	7.90
		Total	13.00	15.80	22.40	12.00

Source: Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19.
Note: Landlessness is the percentage of households without agricultural land.

As per the CSES 1999, the average size of agricultural land parcels for 17 provinces was more than 1 hectare in rural areas. The variation seems to be fairly large across the provinces (Table 3.15). A land parcel may be defined as a contiguous piece of land under a single ownership.

Map 3.6 - PERCENTAGE OF POPULATION WITH PRIMARY EDUCATIONAL ATTAINMENT

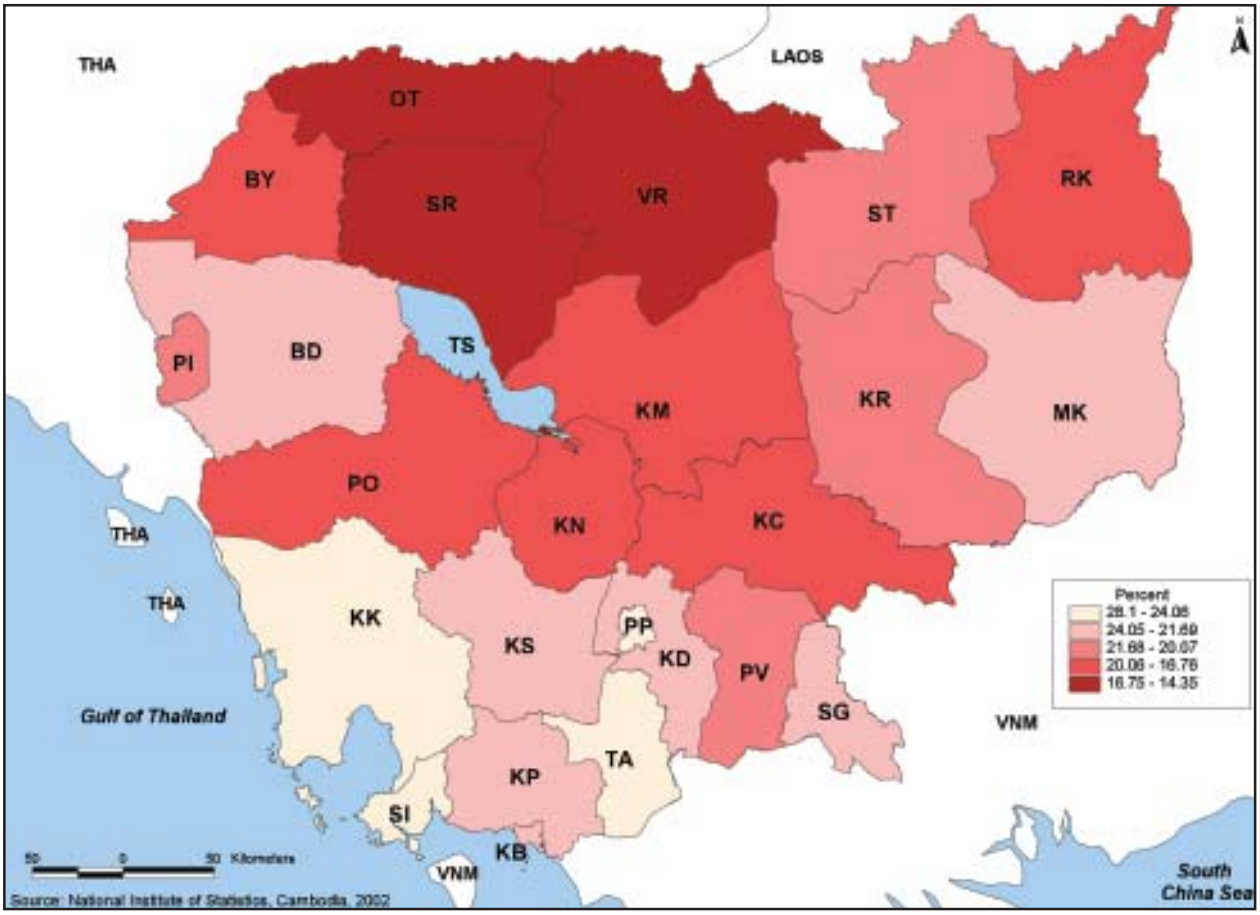


Table 3.16 - Average size of Agricultural Land per Household (in Ha)

No	Survey	Average Size of Agricultural Landholding per Household		
		Male-Headed	Female-Headed	Total
1	CSES - 97 (Rural)	1.18	0.67	1.07
2	CSES - 99 (Rural)	1.41	0.98	1.33
3	CSES-99 (Total)	1.33	0.87	0.23
4	Follow-up-00	0.96	0.83	0.96

Source: Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19.

3. Land Inequality in Agricultural Land

The CSES 1999 indicates that in rural Cambodia, 44% of households controlled 82% of land. The average size of the holding in 1999 was larger than one hectare for this 44% of the population. The remaining 56% of the households at the lower end controlled only 18% of the land. The Gini-coefficient of agricultural land concentration works out to be 0.57, which is an indication of high inequality in the distribution of agricultural land. There was a feeling that landlessness had increased and that inequality had widened since

1998. If we include urban and rural agricultural lands the Gini coefficient was 0.66 in 1999[72]. For residential lands, it was higher at 0.68.

The reasons that can explain the high inequality in land distribution are demographic pressures, the unsettled population and weak credit markets that lead

Table 3.17 - Suspected and Confirmed Landmine-Affected Areas, 2001

No		Province	Suspected (sq.km)	Confirmed (sq.km)	% of Suspected to Total Land Area	% of Confirmed to Total Land Area
1	p	Banteay Meanchey	69.23	114.08	1.13	1.87
2	p	Battambang	290.65	270.56	2.46	2.29
3	p	Kampong Cham	19.15	52.05	0.20	0.55
4	p	Kampong Chhnang	0.00	4.44	0.00	0.08
5	p	Kampong Speu	38.73	82.36	0.56	1.18
6	p	Kampong Thom	11.93	22.74	0.10	0.18
7	p	Kampot	103.61	150.17	2.21	3.20
8	p	Kandal	0.00	0.00	0.00	0.00
9	p	Koh Kong	0.35	5.61	0.00	0.05
10	p	Kratie	0.00	5.07	0.00	0.04
11	m	Kep	8.97	13.82	6.05	9.32
12	m	Pailin	24.48	76.78	2.27	7.11
13	m	Sihanoukville	2.84	5.75	0.21	0.43
14	p	Mondul Kiri	0.00	0.00	0.00	0.00
15	p	Oddar Meanchey	272.23	160.28	5.24	3.09
16	m	Phnom Penh	0.00	0.00	0.00	0.00
17	p	Pursat	10.98	14.27	0.09	0.12
18	p	Preah Vihear	17.51	51.78	0.13	0.37
19	p	Prey Veng	0.00	0.00	0.00	0.00
20	p	Ratanak Kiri	0.00	0.00	N/A	N/A
21	p	Siemreap	12.51	40.95	0.10	0.34
22	p	Stung Treng	0.00	0.00	0.00	0.00
23	p	Svay Rieng	11.74	20.38	0.42	0.72
24	p	Takeo	7.01	6.58	0.20	0.19
		Total (Cambodia)	**901.99**	**1097.75**	**0.50**	**0.61**

Source: Calculations based on - Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19.

to indebtedness and loss of land. Speculative land purchases by wealthy urban residents have added to the inequality.

4. Landmines

Another major issue that concerns the country is the problem of landmines and unexploded ordnance (UXOs). This is another major reason for the reduced availability of land for agriculture. Landmines create a danger to people and, hence, in such areas, the density of population is not high. Moreover, due to the fear of accidents, potential tourism activities are also reduced. The provinces that are suspected to contain the most mines and UXOs include Battambang, Oddar Meanchey and Kampot.

Ever since peace returned in 1992, there has been an effort to de-mine the country. Several donor countries have helped Cambodia de-mine the affected areas. The major provinces affected by the problem of landmines include Kep, Pailin, Kampot, Oddar Meanchey, Banteay Meanchey and Battambang (Table 3.17).

5. Land Laws on Possession and Ownership

Cambodia had a formal law regarding land administration during the French rule that existed for over 40 years. After the end of the colonial rule, the Pol Pot regime promoted 'land collectivism'. As a result, land records, maps and documents regarding ownership were destroyed and the period was marked by unrest and the movement of people to safer areas. When people finally returned, as the country seemed to gain stability, land ownership rights could not be re-established. Some people who held land were forced to part with it, and conditions gave way to clashes on land rights, land grabbing and encroachment.

In the 1980s, the State owned all land. All previous claims to land (before 1979) were invalidated, and only residential rights were given to people. Private property rights were reintroduced for residential plots up to 2,000 square metres. Three categories of land were established that included (a) Land for domicile (b) Land for cultivation and (c) Land under concessions. Private ownership rights could be obtained only on the first category, whereas possession/user rights were issued from the other two.

After the return of peace and stability in 1992, an attempt was made to reallocate land. Agricultural land was distributed according to the number of potential workers in the household. According to a study, agricultural land rose from 3.69 million hectares to 3.91 million hectares during the 1990s. This was done partly by the clearing of the forests and partly through encroachment into swamps and water bodies.

The land allotment policy appears to have resulted in larger households receiving larger areas of land and smaller households (women-headed households) receiving smaller areas of land. Through the Land Law of 1992, people could apply for land tenure certificates that confirmed occupancy and user rights. Agricultural concessions were also given out to companies and individuals to facilitate commercial farming, the aim being to enhance production in the country for domestic and export markets.

A new Land Law took effect in August 2001 with support from the Asian Development Bank. A special Cadastral Commission was established to resolve land disputes. The Commission prohibited the new occupation of land after the law took effect and created social concessions. The law is being administered in two phases and the government appears to have made some progress in the first phase. Important objectives that remain include drafting regulatory texts to implement the new law, building the capacity of government staff and members of the judiciary, and increasing awareness among the poor and legal assistance to the poor.

6. Land Titling[73]

Land titling offers a variety of benefits such as better agricultural investments. The titles can also be held as collateral for credit. A large number of titles are reported to have been issued in Kandal, Takeo, Kampot and

[72] Sophal Chan, Saravy Tep, and Acharya Sarathi, "Land Tenure in Cambodia", Working paper, Cambodia Development Research Institute, Phnom Penh, 2001.

Siemreap. No titles, however, were issued in Mondul Kiri. (Table 3.18).

According to the CSES 1999, 89.5% of the rural population reported that they owned agricultural land with title and 5.7% reported land without title. While about 89.1% were reported to have ownership to residential land with title, 10.1% were reported to be without title. Only a small percentage, 0.81% had rented or leased out residential land[74]. This information, however, needs to be interpreted with caution as various documents of possession of land are in circulation.

Table 3.18 - Land Registration Progress, 1989-2000 (units in numbers)

No		Province	(A) Certificate of Possesion (1989-95)	(B) Certificate of Possession (1995-2000 end)	Total
1	p	Banteay Meanchey	13641	3745	17386
2	p	Battambang	19432	6683	26115
3	p	Kampong Cham	16618	6505	23123
4	p	Kampong Chhnang	25981	3291	29272
5	p	Kampong Speu	22469	4204	26673
6	p	Kampong Thom	4973	2152	7125
7	p	Kampot	54462	1668	56130
8	p	Kandal	109749	9675	119424
9	p	Koh Kong	6490	2756	9246
10	p	Kratie	3064	1261	4325
11	m	Kep	570	783	1353
12	m	Pailin	0	31	31
13	m	Sihanoukville	11659	5779	17438
14	p	Mondul Kiri	0	0	0
15	p	Oddar Meanchey	0	95	95
16	m	Phnom Penh	1028	4621	5649
17	p	Pursat	10857	4140	14997
18	p	Preah Vihear	0	104	104
19	p	Prey Veng	36884	2061	38945
20	p	Ratanak Kiri	436	1056	1492
21	p	Siemreap	28098	5041	33139
22	p	Stung Treng	0	128	128
23	p	Svay Rieng	38530	1808	40338
24	p	Takeo	43336	2770	46106
		Total	**448277**	**70357**	**518634**

Source: Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19.

In 2001, the number of parcels to be titled was estimated at about 6-7 million. Of this number, some 820,000 are reported to have been registered by 2005. Provisional estimates from CSES 2004 point to some 22.5 % of agricultural land secured by title and 52.2% of agricultural land secured by other paper.

3. 4 Profitability of Farming

The average size of land cultivated in Cambodia is around 1.0 hectare and hence brings to the fore the question of the viability of farming and its capacity to provide livelihoods to people. In case it fails to provide viable livelihoods, migration as manual labour at exploitative wages may increase. Hence, efforts should be made to provide skills to people and train them for more remunerative jobs on the one hand, and to make their present occupation of farming viable. The size of the land holding and access to assets for local communities determine the viability of farming by small holdings and the potential of agriculture to provide livelihoods in future. Some information

[73] Sophal Chan, Saravy Tep, and Acharya Sarathi, "Land Tenure in Cambodia", Working paper, Cambodia Development Research Institute, Phnom Penh, 2001.

[74] There could be some overlap between the homestead land and agricultural land.

Table 3.19 - Average Land per Household and Parcel Size (in Ha)

No		Province	CSES1997(Rural) (Ha/H.H)	CSES1999(Rural) (Ha/H.H)	CSES1999 Size (Ha/ Parcels)
1	p	Banteay Meanchey	2.05	1.81	1.64
2	p	Battambang	1.15	1.81	1.33
3	p	Kampong Cham	0.63	1.51	0.79
4	p	Kampong Chhnang	0.43	1.10	0.64
5	p	Kampong Speu	0.91	0.66	0.56
6	p	Kampong Thom	1.31	1.41	0.54
7	p	Kampot	0.77	1.21	0.75
8	p	Kandal	0.79	1.00	0.69
9	p	Koh Kong	4.38	0.52	0.75
10	p	Kratie	1.23	1.38	1.29
11	m	Kep			0.72
12	m	Pailin			1.47
13	m	Sihanoukville	0.40		1.31
14	p	Mondul Kiri			1.10
15	p	Oddar Meanchey		1.08	1.36
16	m	Phnom Penh		0.24	0.74
17	p	Pursat	1.81	1.27	0.76
18	p	Preah Vihear		1.40	1.07
19	p	Prey Veng	1.09	1.38	1.22
20	p	Ratanak Kiri	0.42	2.41	1.78
21	p	Siemreap	0.97	1.95	1.24
22	p	Stung Treng	1.87	1.99	1.09
23	p	Svay Rieng	1.28	1.42	0.60
24	p	Takeo	0.83	1.35	1.22
		Total	1.07	1.33	0.90

Source: Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19. Note: Obtained for the year 1997 and 1999 SES- Social-Economic Survey
LH-Land Holdings.

on the average costs of farming was collected by the government in the CSES 2004. These provisional estimates bring out some interesting points.

Cost of Crop Production

The breakdown of expenses of crop production in the wet season and the dry season show that chemical fertilizers and planting material comprised a substantial

percentage of the cost of crop production in both the seasons. However, pesticide, herbicide and fungicide comprised only 1% of the cost in the wet season, whereas in the dry season, it was 7%. In the wet season, the largest expenditure was on hired draught power (25%). The wet season also saw farmers spending more on animal and plant manure. As would be expected, in the dry season, more money was directed towards irrigation (7.8%). The electricity expenses were also high in the dry season. Electrical pumps were probably used to lift surface water and ground water for irrigation. The total imputed rental of farmland in the wet season was 2.9%, whereas in the dry season it was only 1.4% (Table 3.20).

Table 3.21 - Value-Added of Crop Production (in %)

No	Description	Wet Season	Dry Season	Total
1	Gross Output	100.0	100.0	100.0
2	Post Harvest Loss	3.8	3.6	3.7
3	Net Output	96.2	96.4	96.3
4	Cost	38.7	39.1	38.8
5	Value Added	57.4	57.4	57.4

Source: Quick estimates of 2004 Socio-Economi c Survey. Courtesy: Wold Bank.

Table 3.20 - Cost of Crop Production (Percentage to Total Cost)

No	Item	Wet Season (%)	Dry Season (%)
1	Planting Material	19.20	18.40
2	Chemical Fertilizers	24.40	20.10
3	Animal & Plant Manure	6.10	1.30
4	Pesticide, Weedicide & Fungicide	1.30	7.30
5	Electricity, Oil, Gas, Diesel Oil for the Farming	1.90	11.10
6	Storage Items	3.50	2.80
7	Payment for Hired Draught Power	25.30	17.10
8	Other Hired Labor Charges	7.40	7.60
9	Irrigation Charges	1.70	7.80
10	Services/Technical Supports from Govt. & Others	0.00	0.10
11	Transportation of Input Materials & Products	2.20	2.90
12	Repair & Maintenance of Farm House, Animal Shed	1.60	0.60
13	Repair & Maintenance of Farm Equipment	2.50	1.50
14	Rental Paid to Owner for Farm Land (in cash)	1.70	1.00
15	Rental Paid to Owner for Farm Land (in kind)	1.20	0.40
16	Rental Paid to Owner for Farm House, Equipment etc.	0.20	0.00
	Total	**100.00**	**100.00**

Source: Quick Estimates of 2004 Socio-Economic Survey. Courtesy: Wold Bank.

Value-added of Crop Production

There was not much difference between the wet season and dry season in terms of value-added production. The post-harvest loss was very low, contrary to what is normally expected in developing economies. It was reported as less than 4% of output. This is probably because such losses are low on the subsistence farms. Commercial losses would be high when the produce goes to markets and inefficient mills. The cost of production comprised a little less than 40% of the gross output. The value added, on the other hand, was quite high, at 57.4%, for both the wet and dry season crop. Thus, on the whole, crop production seems to be a profitable activity. One must caution

that this may or may not hold true for individual farmers in drought or flood hit regions. Furthermore, without data from different size classes of landholdings, we cannot conclude that all farms are functioning profitably (Table 3.21).

3.5 Access to Natural Resources

Access to natural resources that include land, forest and water bodies has been changing and has been constrained due to the concessions or rights of use given by the government to individuals and companies other than local residents. Concessions refer to land that is given away on lease for productive purposes, such as commercial farming, growing of farm products, scientific logging of forests, fishing rights on a specified geographical area, etc. The rationale behind such leases was to benefit the country by generating revenue for the State. This practice has been going on since the days of French rule prior to 1953. Such concessions sometimes become a major obstacle to the local population as access to resources decline in those areas. Access to natural resources is vital for livelihoods. As a consequence, poverty reduction in a subsistence rural economy is often directly related to the free access to natural resources, such as water, forests, fuel, building material, wild foods, grazing lands, fish, etc.

Another important aspect is the state of natural resources. Forests, agricultural land and water bodies are more likely to be exploited in a sustainable manner by the local population under the guidance of the government, rather than by foreign companies or individuals using them for commercial purposes, if controls are weak.

A positive aspect is that the Royal Government of Cambodia has realised the importance of access to natural resources by local communities and has progressively reduced areas under lease or concession. Furthermore, local people have been given access to social concessions. The government has also taken several steps to ensure a sustainable exploitation of resources. Notable among them are the restrictions on felling trees without an assurance of sustainable regeneration and catching fish during the breeding season. Natural resource access, however, remains a major issue as long as a large number of people live in rural areas and are dependent on land-based livelihoods.

1. Land Concessions

Access to grazing lands, forests, water bodies and fishing grounds does not require title or ownership, but requires physical access. Such physical access is restricted, once

Table 3.22 - Land Concessions Given for Crops

No	Crops	Concession - Area
1	Rice	301.5 sq km (of which 127 sq km are for cassava)
2	Cassava	210.5 sq km (127 sq km include rice; 5.5 sq km, fruits)
3	Rubber	822.7 sq km (of which 100 sq km are for palm-oil)
4	Potato	396 sq km
5	Sweet Potato	183 sq km
6	Cashew	3475.06 sq km

Source: Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19.

Table 3.23 - Land Concessions by Province

No		Province	Concession Area (sq. km)	Total Land (sq. km)	Concession as a % of Total Land
1	p	Battambang	20.00	11830.34	0.17
2	p	Kampong Cham	263.70	9488.60	2.78
3	p	Kampong Chhnang	3150.00	5303.69	59.39
4	p	Kampong Speu	1296.96	6973.33	18.60
5	p	Kampong Thom	244.00	12474.04	1.96
6	p	Kampot	245.00	4695.21	5.22
7	p	Koh Kong	653.80	11972.78	5.46
8	m	Sihanoukville	110.00	1344.84	8.18
9	p	Mondul Kiri	202.00	13675.69	1.48
10	p	Pursat	33.00	11563.02	0.29
11	p	Ratanak Kiri	260.00	11792.12	NA
12	p	Stung Treng	74.00	12031.61	0.62
13	p	Takeo	15.50	3487.79	0.44
		Total	6567.96	116633.05	

Source: Sarthi Acharya,et al, Total Agricultural Land from IRRI;Total Concessional Area (1999) from working paper.
Note: Data converted into sq km
Concessional Area: TGA - 3.62%
Concessional Area: TGA (Specific Provices) - 5.63%

land is under commercial lease or concession. In recent years, riparian communities have faced shrinking access to their fishing areas. The main problems in Cambodia include population pressure and the spread of crop agriculture that threatens fisheries in the Tonle Sap Lake.

A total of 6,568 sq km of land has been given as agricultural concessions. Specific province-level details are available from some studies, though the latest situation is not known. A large area has been given away in Kampong Chhnang. Major crops for which

Table 3.24 - Forest Concessions by Province

No		Province	Forest (Ha)	Concession Area(2001) (Ha)	Concession Area Exclusive for that Region (Ha)
1	p	Banteay Meanchey	219970.31		
2	p	Battambang	603796.90	214000.00	
3	p	Kampong Cham	263597.64	827434.00	
4	p	Kampong Chhnang	253136.95		
5	p	Kampong Speu	422581.72	591517.00	
6	p	Kampong Thom	579797.59	555617.00	147187.00
7	p	Kampot	244687.86	557225.00	
8	p	Kandal	0.00		
9	p	Koh Kong	1030191.54	524318.00	10000.00
10	p	Kratie	1040697.29	1706395.00	131380.00
11	m	Kep	1862.14		
12	m	Pailin	106586.66		
13	m	Sihanoukville	97145.46		
14	p	Mondul Kiri	1285691.80	986743.00	218059.00
15	p	Oddar Meanchey	420845.58		
16	m	Phnom Penh	0.00		
17	p	Pursat	832104.91	825620.00	
18	p	Preah Vihear	1262990.50	1217875.00	103300.00
19	p	Prey Veng	1437.05		
20	p	Ratanak Kiri	971948.76	410150.00	60150.00
21	p	Siemreap	569155.93	595950.00	200050.00
22	p	Stung Treng	1125952.13	796301.00	
23	p	Svay Rieng	3898.87		
24	p	Takeo	1142.96		
25		Tonle Sap	0.00		
		Total	11339220.55	4212278.00	

Source: Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19.

concessions have been given include cashew, potato, rubber, rice, cassava and sweet potato. Cashew forms the largest area. Around 52.9% of the total area under cashew has been given away for concessions followed by rubber, potato and rice. (Table 3. 22 and 3.23).

While contract farming is expected to enhance the GDP and revenue to the exchequer, the present policy of land concessions has not produced a significant development in the agricultural sector. Many land concessions are inactive and do not produce employment for rural landless labour.

Contract farming may also have some adverse impact on the livelihoods of local population. First, the land available for cultivation by the local population declines and they progressively get reduced to landless labour. Second, most of the produce from contract farming is sent to neighbouring countries as primary products without any value addition in Cambodia. Hence job opportunities also shift to those countries. Further, the country also loses in the long run if its primary products are exported at low prices and value-added products are imported at higher prices. Unless alternative livelihoods are created for the local population, land concessions will continue to be a sensitive issue.

2. Forest Concessions and Access to Natural Resources

A total of 4.2 million hectares was given under forest concessions (leases) to companies in the year 2001. That constituted about 37.1% of the total forest area. As per the records of 1999, the forest land leased, inventoried and exploited was 2.20 million hectares. Forest land leased inventoried and yet to be exploited was 1.51 million hectares. Forest land leased but not yet inventoried was 2.60 million hectares. Thus, a total of 6.31 million hectares was under lease. After the ban on logging and cancellation of many forest concessions in recent years, particularly after 2003, the area under forest concessions has been reduced.

It is not clear whether the leases are in dense forest area or open forest area. It is quite possible that the forest wealth has already come down on account of the exploitation of forest concessions since the return of peace in 1992. By the time restrictions on forest concessions and logging were imposed in 2003, considerable forest wealth may have been lost. The area under dense forest cover has most probably declined.

Concessions were established to reduce illegal logging, speed-up the growth of value and increase royalties from timber. However, there is no evidence of systematic regeneration or replanting of the forest cut down for timber. Moreover, a considerable amount of illegal logging has been taking place. Commercial forest concessions affect the livelihoods of the local population in two major ways. The first is the reduction in the access to forest for fuel woods, wild foods and timber that puts tremendous pressure on their financial resources and has a relevance to poverty. The second major impact is on potential employment. Exporting logs as primary products also reduces job opportunities for the local population in value-added wood product industries (Table 3.24).

3. Fishing Concessions

Cambodia has large fresh water resources and is one of the countries best endowed in the Asian region. The country is ranked high in the production of fresh water fish. However, Cambodia's water bodies are being affected by excessive silt formation due to deforestation and flooding. The reduction in fish availability, coupled with commercial concessions, has created livelihood problems to those who derive incomes from fishing.

Fishing concessions cover large areas of water bodies and land areas prone to flooding. Fishing contracts are given for a period of one to five years and there are three sizes of fishing lots: large, medium and small. Around one million hectares of water bodies have been given out under fishing contracts. (Table 3.25). Recently, there has been a move to reduce commercial leases and release about half of the fishing area to the local population. A number of fishing lots were cancelled from the year 2001.

Table 3.25 - Size and Number of Fishing Lots - 2000

No	Size of Lots (sq km)	Number of Lots	% of Lots per Total Area
1	<10	39	23
2	10-<20	20	12
3	20-<40	33	20
4	40-<60	18	11
5	60-<80	19	11
6	80-<100	8	5
7	100-<150	17	10
8	>150	14	8
	Total	168	100

Total Area=9634 sq km. Source: Chan Sophal, Tep Saravy and Sarthi Acharya, "Land Tenure in Cambodia", a data update, working paper 19

CHAPTER 3

Section B

Correlates of Poverty

3.6 Factors Affecting Poverty

Several factors influence the level of poverty. A better understanding of the factors that influence poverty would be necessary to frame realistic and workable policies and programmes to reduce poverty. Some factors are important at the macro-level and others at the micro-level. Hence, the section attempts an analysis both at the province level, as well as at the household level. The significance of the factor by itself is not conclusive proof that it is the most relevant or irrelevant. If a factor, which is normally believed to influence poverty, is not found to do so, it is important to probe further before a policy or programme is adopted.

Provincial-level analysis normally holds true only if the provinces are homogenous in character. Hence what is found insignificant at the province level may be found significant at the household level. The data itself has several limitations and hence the results need to be seen only as broad indications of the factors that influence the level of poverty.

3.6.1 Provincial-level Analysis

One set of factors that influence poverty is related to human endowments, such as literacy, education, skills, etc. The other set of factors is related to the food production of the region, such as availability of food grains, stable agriculture, impact of floods and droughts. More stable rice yields and abundance of rice production are also important to poverty reduction and livelihood sustainability. The impact of these two sets of factors has been examined at the province level within the data limitations.

Education plays a very important role in reducing poverty. It is a common observation that the poverty rates are much higher for illiterate rural households compared to well-educated urban households. The capital city of Phnom Penh has a low poverty rate and a high literacy rate. One of the reasons for low poverty is the fact that well educated people earn higher incomes.

In contrast to literacy, unemployment may be higher in the areas of lower poverty, especially in the urban context. Unlike in rural areas, where people take up any work in order to subsist, educated people in urban areas may choose not work, since they have the staying power to wait for a job that gives them their expected income. Hence, some of these people may prefer to remain jobless rather than work in an underpaid job. With education, the underemployment or disguised unemployment becomes open unemployment, which is what seems to have happened in Cambodia between 1998 and 2004.

However, such clear-cut relationships break down, once we go down to the various levels of education and unemployment within rural areas. Similarly, special variations in poverty are lost in the aggregate picture of the province. Hence, we first looked at the data before testing for the statistical significance of the relationship.

Provinces that show a negative relationship between poverty and unemployment are Phnom Penh, Koh Kong, Kep, Pailin, Pursat, Prey Veng and Svay Rieng, as per the 1998 Census data. They seem to have

higher poverty rates and low unemployment rates, or vice versa. Of these places, Phnom Penh, Kep and Pailin are municipalities, and thus the levels of the educated unemployed are high, leading to high levels of unemployed with low poverty rates. The other rural provinces of Pursat, Prey Veng and Svay Rieng show higher poverty rates and low unemployment. There is a possibility of a large amount of underemployment in these densely populated provinces.

Seven factors for which data are available have been used as independent variables in the regression analysis. The absence of data was the main reason for restricting the analysis to only these factors, though they turned out to be poor proxies. The seven variables which were regressed on the headcount ratio of poverty are: total literacy rate, unemployment rate, female literacy rate, percentage of population who completed primary education, percentage of population with access to electricity, per capita deficit in cereal production over consumption per capita and instability in rice yields.

Regression analysis was undertaken to establish a relation between the poverty rate and the other factors. The data used for regressions was mostly from 1998. Due to non-availability of data for all provinces on rice instability, two different data sets were taken – one that includes the rice instability of just 21 provinces, and another that altogether excludes rice instability. However, these regressions are not presented, since no relationship could be established between the instability in rice yields and poverty at the province level. Some of the independent variables were excluded from regression equations as they were correlated.

Four equations were estimated. Two of them did not offer a good fit, and thus do not have the explanatory capacity to account for the variations observed in poverty. The equation with female literacy, percentage of population who have completed primary education and the per capita deficit in rice production over consumption turned out to have an explanatory capacity, with a significant value of R square at the 5 percent level. In this equation, the percentage of the population with primary education turned out to be significant with a negative impact on poverty.

It indicates that factors such as female literacy, primary education, and availability of food grains in abundance, which is also a proxy for livelihood access, exert some influence on the head count ratio of poverty. If there are more people who have attained primary education levels, the poverty would be lower in those provinces. Also, the higher the deficit in rice production, the larger the incidence of poverty (Appendix 3.2).

In other words, poverty at the province level does not only depend upon the literacy rate or unemployment rate. The implication is that, as one crosses the level of primary education, education helps further reduce poverty. With education above the primary level, people shift to non-agricultural occupations.

Poverty also depends upon a whole series of factors other than literacy and the deficit in production of cereals at the province level. However, we could not examine the other factors, such as access to land, access to productive assets, access to credit, infrastructure facilities, access to markets, etc.

3.6.2. Household-Level Analysis (Cambodia Socio-Economic Survey -2004)

It is appropriate to define the food poverty line in terms of calorie intake at the household level. In the case of Cambodia, the food poverty line was defined in calorie terms as 2,100 kilocalories per capita per day.[75] However, as noted earlier, the food poverty line was not established by directly measuring the quantities of the various essential food items consumed. It was calculated from the values of expenditure for food consumption, against a reference food basket.

It is noted, however, that there are several problems with the food poverty line defined in value terms, since it cannot reflect consumption accurately. It is no more than a poverty line for the extreme poor.

[75]Royal Government of Cambodia, Ministry of Planning and UNDP, "Estimation of Poverty Rates at Commune level in Cambodia", October 2002.

In other developing countries of Asia, for instance, sample survey data have shown that the actual calorie consumption and the value of consumption adjusted for prices have diverged so greatly over a given period that the correspondence of the value of the food basket with the calorie consumption is totally lost.[76]

Considering the limitations of the data, it is wise not to comment on income poverty. We would need to wait for the conclusions of the ongoing World Bank-assisted Cambodia Poverty Assessment Report to draw any conclusions on the magnitude of poverty. More detailed surveys in future are also required to assess the adequacy of consumption in calorie terms.

The controversy over the poverty lines, and consequently, the assessment of the magnitude of the poverty is well known in the poverty literature of developing countries. India is a case in point. Most of the arguments often remain inconclusive. In the present study, the main focus is not on the percentage of households below the chosen value of food consumption but on the factors that influence the value of consumption and the variations in consumption, especially in the lean months.

Description of Data Used

The CSES 2004 collected data for 15,000 households for 24 provinces. A thousand households were interviewed per month, starting from November 2003 to January 2005 for a period of 15 months. The households were spread across the 24 provinces. (Table 3.26). In this section, the unit-level data set of 9,000 households of nine months from November 2003 to July 2004 has been used to examine the lean period consumption and the factors that influence consumption.

The average per capita value of daily food consumption for a nine month period was lower, at 1,829 Riels, compared to the average value of per capita per day consumption of 15 months, at 1,932 Riels. We have reasons to believe from our earlier analysis that rural people, and especially those living in inaccessible areas, would have a much greater variation between lean season consumption and consumption over other times in the year. In fact, the nine month data set was chosen to study the vulnerability to consumption. The analysis is restricted to only food consumption of 18 items as elaborated below. Since the focus of our study is only on food security and the transient food shortages of poverty groups, we did not analyse information on the total value of consumption.

One of the reasons for not undertaking an analysis of the large number of variables available in the data set was the limitation in time, given the inconsistencies that existed in the data set. Many inconsistencies were observed. For some attributes there was no information, data are not available for all households on all items of information collected, etc. Hence, before undertaking any exercise, we needed to remove those households with an incomplete data set. For unemployment, data was available only for 1,099 households; almost 7,900 households had no information. We could not use the unemployment information–those actively seeking employment–as it was missing for a large number of households (Appendix 3.3).

After deleting those households for which the data set was not complete, we obtained information for about 8,986 households. This information was used to examine the characteristics of the sample households. The information on the value of food consumption of 18 items pertains to the entire household, whereas information on literacy, unemployment and land ownership pertains to the respondent in the household. Information on employment, occupational status, etc. for the rest of the members of the household is not known. We have presumed that the respondent is the head of the household. All the estimates presented are valid only for the sample households for the period of nine months.

The averages were calculated for Cambodia and the regression analysis results are valid for the entire

[76]Ravallion, M "Should Poverty Measures be Anchored to the National Accounts?" Economic and Political Weekly, 35, (4) 2000

[77]Ministry of Planning and UNDP, op. cited.

Table 3.26 - Representative Samples at Provincial Level

No		Province	Household Sample Size CSES 2003-05	Household Sample Size Taken by Us
1	p	Banteay Meanchey	770	480
2	p	Battambang	1020	667
3	p	Kampong Cham	2040	1200
4	p	Kampong Speu	770	479
5	p	Kampong Thom	740	460
6	p	Kampot	700	418
7	p	Kandal	1350	774
8	m	Phnom Penh	1400	835
9	p	Prey Veng	1280	90
10	p	Siemreap	870	590
11	p	Svay Rieng	640	380
12	p	Takeo	1030	630

Source: Computed from CSES 2004 database.

country for the nine-month period. The provincial-level sample household averages may not be representative, given the small size of the sample. However, we have presented the figures all the same, as they hold good for the sample households, and some insights could be gained out of the observations as case studies.

Variables considered for the household-level analysis

1) Value of food consumption for major food items

The value of consumption is available for 20 different food items that also included alcohol and tobacco. The values given in the unit-level data are the total values in Riels for the household, as a whole, for a period of seven days on 20 different items. In order to derive the value of food consumption, the values of consumption of tobacco and alcohol were removed, since they do not have any food value. The value of consumption of 18 food items were considered. To compute the daily consumption value, the value of consumption of each of these items was totaled. Further it was divided by the household size (number of members in the household) to obtain the daily per capita value of food consumption.

2) Value of cereal consumption

The cereal consumption was divided into homegrown consumption and purchased consumption. Hence, it was possible to arrive at the percentage of homegrown cereal consumption to total cereal consumption.

3) Size of the household

The number of members in the household was available, but the details about their age and sex composition and employment status were not known.

4) Literacy of the respondent

A literate person, as per the definition, is a person who can read and write. A person who cannot read and write is considered illiterate. The information available was qualitative and binary in nature and answered in the negative or affirmative, ('Yes' or 'No').

5) Ownership of land

This information seemed to have some inconsistencies. All the households possessed land. Obviously, the homestead on which the household is situated was considered as possession of land. Land is either owned or leased-out, used without any ownership rights, or belongs to the community or government. Land used for homestead and land cultivation was not separated. Hence, it was not possible to differentiate between cultivated land and other types of land. Thus, no attempt was made to extract details about the extent of land ownership and operation. The only information we could extract was whether households owned land or not. This only gave us information as to how many households do not own their homesteads.

6) Head of the household

Whenever a respondent was a woman, the household was considered as being headed by a woman.

7) Occupational structure

The classification of occupation was as follows.

i. A person is engaged in growing crops for the market;

ii. A person is engaged in subsistence farming;

iii. A person is employed as a labourer; or

iv. A person works in other categories - this included those not in crop production but engaged in livestock, fisheries, forestry, or working in the government services.

Since the sample is geographically selected and proportional to the population and did not have any further stratification based on income or land ownership status, no further weighting was required. An average household consumption was a valid figure for the sample. The observations of this analysis cannot be used for predictive purposes, since most of the values are qualitative and they reduce the predictive capacity of the models. Despite the limitations, since the sample is very large, the average for the large number of households helped us to derive some conclusions about the interrelationships between the variables.

Per Capita Daily Value of Food for the Sample Households

We found that 27.7% of the sample households fall under the category of those consuming food of the value of 1,000 Riels or less per day. If we include tobacco and alcohol, we find 23.8% of the sample households consuming the value of food less than 1,000 Riels per capita per day, for the nine-month sample.

The 15-month sample also shows similar results. It shows that 23.4% of the sample households are consuming food of the value of 1,000 Riels or below per capita per day, if the values of alcohol and tobacco are excluded. About 20% of the sample households consumed food of the value of 1,000 Riels or less per capita per day if we include the value of alcohol and tobacco. In both samples, 71% and 67% of the households seem to consume food valued at less than 2,000 Riels per capita per day.

The nine-month sample showed a higher percentage of sample households as consuming a lower value of food in the lean months of the year. On the whole it appears that income poverty, on the border of food deprivation at least in some months, afflicts more than a fifth of the population in Cambodia (Tables 3.27, 3.28 and 3.29).

The variation across the provinces was very high for the per capita per day value of cereal consumption. If we consider the average value of total food consumption for each province, the highest value is found in the province of Phnom Penh at 3,361 Riels and the lowest in the province of Kampong Speu at 1,206 Riels (Table 3.30 and 3.31).

Per Capita Daily Cereal Consumption

For 42% of the households surveyed, the value of cereal consumption comprised 25-50% of their total value of food consumption. The next largest group, 40% of the sample, fell in the category of those whose value of cereal consumption was 10-25% of total value of food consumption. Therefore, most of the population had between 10-50 % of total consumption being allocated to cereals. In terms of the amount of money spent on cereals, almost 60% of the households spent between 500 to 1,000 Riels per day on cereal consumption. For 42 % of the sample households, the cereals consumed were entirely from home grown sources. Whereas, for almost 50% there were no homegrown cereals at all- showing that many depended upon the purchase of cereals at least in the lean months. Many landless households also entirely depend upon purchased cereal.

Kandal had the highest proportion (10.97%), spending below 100 Riels per capita per day on cereal consumption. On average, most of the population seemed to be spending in the range of 100 to 500 Riels on cereal consumption per day per capita. Data for Kratie suggested that more than 80% of the population spent around 1,000 to 2,000 Riels on cereal

Table 3.27 - Distribution of Households by Value of per Capita Daily Consumption (Excludes Tobacco and Alchohol)

No	Riels	No. of Sample Households	Percent
1	Upto 1000	2492	27.70
2	1001 to 2000	3952	44.00
3	2001 to 4000	2001	22.30
4	4001 to 10000	520	5.80
5	10001 to 20000	19	0.20
6	20001 to 40000	1	0.00
7	Above 40000	1	0.00
8	**Total**	**8986**	**100.00**

Source: Computed from 9,000 sample households of CSES 2004 database.
Note: Excludes Tobacco and Alchohol.

Table 3.28 - Distribution of Households by Value of per Capita Daily Consumption (Includes Tabacco and Alchohol)

No	Riels	No. of Sample Households	Percent
1	Upto 1000	2142	23.80
2	1001 to 2000	4045	45.00
3	2001 to 4000	2189	24.40
4	4001 to 10000	582	6.50
5	10001 to 20000	26	0.30
6	20001 to 40000	1	0.00
7	Above 40000	1	0.00
8	Total	8986	100

Source: Computed from 9,000 sample households of CSES 2004 database.
Note: Includes Tobacco and Alchohol

Table 3.29 - Distribution of Households by Value of per Capita Daily Consumption

No	Riels	No. of Sample Households	Percent
1	Upto 1000	3510	23.40
2	1001 to 2000	6979	46.60
3	2001 to 4000	3600	24.00
4	4001 to 10000	863	5.80
5	10001 to 20000	29	0.20
6	20001 to 40000	2	0.00
7	Above 40000	1	0.00
8	Total	14984	100.00

Source: Computed from 15,000 sample households of CSES 2004 database.
Note: Includes Tobacco and Alchohol.

consumption. The municipalities' consumption seemed to range from around 100 to 1,000 Riels on cereal consumption per day per capita (Appendix 3.4).

It is difficult to judge the actual changes in the value of consumption. Furthermore, the food consumption basket differs across provinces, as well as across rural and urban areas. All the same, those who spend below 100 Riels per day on cereal consumption are in need of immediate attention, and poverty-alleviation policies must be targeted towards these sections of the population.

Literacy

As per the CSES 2004, at the national level, the literacy rate was 67%. Oddar Meanchey and Mondul Kiri had the lowest literacy rate of 15% and 16.67% respectively. Phnom Penh had the highest literacy rate of 88%. The literacy rate on an average seemed to be between 60% and 75%. Overall, each province seemed to have a higher number of literates than illiterates (Appendix 3.5).

Table 3.30 Average per Capita Value of Daily Cereal Consumption

No		Province	Total Cereals	Home Grown Cereals (in Riels)
1	p	Banteay Meanchey	453	189
2	p	Battambang	416	114
3	p	Kampong Cham	401	175
4	p	Kampong Chhnang	424	205
5	p	Kampong Speu	385	297
6	p	Kampong Thom	419	215
7	p	Kampot	478	293
8	p	Kandal	439	120
9	p	Koh Kong	367	185
10	p	Kratie	426	174
11	m	Kep	298	292
12	m	Pailin	399	0
13	m	Sihanoukville	441	77
14	p	Mondul Kiri	840	338
15	p	Oddar Meanchey	417	355
16	m	Phnom Penh	532	16
17	p	Pursat	358	228
18	p	Preah Vihear	422	374
19	p	Prey Veng	395	289
20	p	Ratanak Kiri	652	368
21	p	Siemreap	441	228
22	p	Stung Treng	393	267
23	p	Svay Rieng	419	280
24	p	Takeo	458	258
		Cambodia	445	222

Source: Computed from CSES 2004 database.

Landownership Pattern

Almost 70% of the sample households owned land. As has been mentioned earlier, this does not mean that they have land to cultivate, since homestead land might also have been considered as owned land. Separate information on cultivated land was not available.

Occupational Distribution

The majority of the sample households were occupied in the 'others' category. This included those employed in livestock, fisheries, government services, etc. Only 3% in the sample were labourers and 27% were farmers who marketed their produce; about 39% were subsistence farmers.

Distribution of Female-headed Households

All the provinces surveyed had more than 70% of the households headed by men. In Oddar Meanchey and Kep, 95% and 90%, respectively, of the sample households surveyed had male respondents. However, it must be noted that the sample size in these provinces was very small, only 20-30 households, and hence, the sample may not be representative of the real picture. In Phnom Penh and Svay Rieng, female-headed households were almost 28% of the sample households. This was the highest recorded for any province (Table 3.32 and 3.33).

Correlates of the Value of Daily per Capita Consumption

The sample used for regression was limited to 7,734 households. The results are valid for the entire country. The significance of the relationships only shows that the explanatory factors exert sufficient influence on the dependent variable. (Appendix 3.6).

Table 3.31 - Per Capita Daily Value of Food Consumption

No		Province	Food Consumption (in Riels)
1	p	Banteay Meanchey	1944
2	p	Battambang	1781
3	p	Kampong Cham	1632
4	p	Kampong Chhnang	1739
5	p	Kampong Speu	1206
6	p	Kampong Thom	1444
7	p	Kampot	2108
8	p	Kandal	1957
9	p	Koh Kong	1698
10	p	Kratie	1988
11	m	Kep	1394
12	m	Pailin	1758
13	m	Sihanoukville	2786
14	p	Mondul Kiri	1964
15	p	Oddar Meanchey	1967
16	m	Phnom Penh	3361
17	p	Pursat	1458
18	p	Preah Vihear	1287
19	p	Prey Veng	1661
20	p	Ratanak Kiri	1970
21	p	Siemreap	1709
22	p	Stung Treng	1393
23	p	Svay Rieng	1731
24	p	Takeo	1955
		Cambodia	1829

Source: Computed from CSES 2004 database.
Note: Subject to small changes.

The results may be summarised as follows:

*Individuals in the other occupations have higher levels of consumption and, therefore, probably a greater calorie intake. Those who market their produce also have a high level of food consumption, but labourers and subsistence farmers have comparatively lower levels of consumption. Their consumption levels are 616 and 543 Riels per capita per day less than that of the people in the other occupations. This has important implications for government policy. Programmes aimed at improving nutrition and consumption levels should perhaps target agricultural labour and subsistence farmers.

*Households, with literate heads of household have higher per capita daily consumption than households with an illiterate head of the household. It may be noted that in the province-level analysis, literacy did not influence poverty. However, at the household level, literacy improves consumption per capita, meaning that even minimum literacy has an influence on income earning opportunities.

*Per capita daily consumption was higher for smaller households with fewer members and lower for larger households with more members. Further, the household size was larger when the head was illiterate. Among the occupational groups, subsistence farmers had larger households than the category of other occupations, but the labour households had the smallest size of households of all the categories. Female-headed households were also smaller in size.

*While the total food consumption was higher when the head of the household was literate, there was no impact on the cereal consumption of households. This means that cereal consumption remains unaffected by literacy levels. Obviously literacy is useful for earning more to broaden the food basket. We find that female-headed households consumed more cereal than the male-headed households. This result is difficult to interpret as being positive, since it may mean that the food basket is limited in the female-headed households.

Table 3.32- National Level Distribution of Female-Headed Households

Category	No.of Households	Percent	Percent	Cumulative %
Male	6955	77.40	77.40	77.40
Female	2031	22.60	22.60	100.00
Total	8986	100.00	100.00	

Source: Computed from 9000 sample households of CSES 2004 database.

Table 3.33 - Provincial Distribution of Head of Households by Gender

No	Province	Sex				Total	
		No. of Sample HH		Valid %		No. of Sample HH	Valid %
		Male	Female	Male	Female		
1	Banteay Meanchey	379	101	78.96	21.04	480	100
2	Battambang	495	172	74.21	25.79	667	100
3	Kampong Cham	941	259	78.42	21.58	1200	100
4	Kampong Chhnang	243	67	78.39	21.61	310	100
5	Kampong Speu	378	101	78.91	21.09	479	100
6	Kampong Thom	371	89	80.65	19.35	460	100
7	Kampot	325	93	77.75	22.25	418	100
8	Kandal	594	185	76.25	23.75	779	100
9	Koh Kong	65	15	81.25	18.75	80	100
10	Kratie	234	45	83.87	16.13	279	100
11	Kep	23	7	76.67	23.33	30	100
12	Pailin	604	231	72.34	27.66	835	100
13	Sihanoukville	89	11	89.00	11.00	100	100
14	Mondul Kiri	89	11	89.00	23.57	100	100
15	Oddar Meanchey	214	66	76.43	23.57	280	100
16	Phnom Penh	80	10	88.89	11.11	90	100
17	Pursat	456	134	77.29	22.71	590	100
18	Preah Vihear	52	18	74.29	25.71	70	100
19	Prey Veng	70	10	87.50	12.50	80	100
20	Ratanak Kiri	274	106	72.11	27.89	380	100
21	Siemreap	503	127	79.84	20.16	630	100
22	Stung Treng	19	1	95.00	5.00	20	100
23	Svay Rieng	27	3	90.00	10.00	30	100
24	Takeo	35	5	87.50	12.50	40	100

Source: Computed from CSES 2004 database.

CHAPTER 3

Section C

Gender Concerns of Cambodia

Both men and women contribute to the growth and development of a nation. Any discrimination will only inhibit economic growth and the well-being of the nation. Bridging the gender gap is one of the major challenges of both developed and developing nations. The Cambodian population now stands at 13.1 million according to 2004 data, and is estimated to reach 16.6 million by 2006. Almost 52% of the population consists of women, who make a substantial contribution to Gross Domestic Product (GDP), export earnings, rice and fish production.

The unequal sharing of the fruits of economic development and GDP growth between men and women workers is the major concern. Often the changing economic situation influences gender roles without changing the levels of discrimination. Discrimination manifests itself in different ways at different levels, denying women their due share.

The workplace relationship between men and women often keeps women below that of men. In family enterprises, social and cultural factors determine the work done by women and men. Men as the heads of the families also assume the supervisory role, even though the work contribution of women is higher. Even when women move from family enterprises to paid work in the organised sector or unorganised sector, workplace relationships continue to keep women below that of men. As in the family enterprise, decision-making and supervisory positions are offered to men, while worker and subordinate positions are offered to women. Further, wage discrimination is common under the pretext that the productivity of men is higher than women.

Workplace discrimination is a manifestation of the differential treatment that boys and girls receive in their own family. Higher education and training opportunities are available to boys. Thus, young women are less qualified than young men when they come to the workplace. Removing such deep-rooted discrimination needs a different type of approach than that of enacting laws of equality at the workplace. Sensitising the society at large and reformist and trade union movements would be more effective, rather than trying to remedy the wrongdoing in each event. Sometimes the economics of employing women at lower wages cannot be remedied unless the State assumes a larger role in bringing about gender equality.

Many gender studies specialists object to the concept of looking at the issues of women from the workplace alone. This is because the reasons for the lack of initiative on the part of women to overcome discrimination at the workplace has its roots in overall power relations and status, as well as a number of social and cultural limitations. Most women put the interests of their families, children and husbands before their own advancement both in social and economic fields. In a male dominated environment, a number of factors, such as education, skills, asset ownership, higher incomes, supervisory positions and business acumen, are in favour of men in general. It becomes very difficult to remove discrimination even in the basic economic entitlements of education, asset ownership, hiring and firing, wages and workplace equality. This is a common problem in the Asian context.

Some of the conditions faced by women in the Cambodian economy can be attributed to the country's tragic past. The internal and external conflicts that devastated the nation forced many women to assume the role of breadwinners for families and contributors to the Cambodian economy.

This section on gender concerns in Cambodia examines issues such as the sex ratio, education, employment, wages, the roles of women in agriculture and industry and the implications to the well-being of women. The Human Development Index (HDI) also reflects the socio-political, economic and cultural development of countries without any discrimination. For Cambodia, the HDI is 0.568.

3.7 Sex Ratios

The sex ratio of Cambodia, as per the 1998 Census, had been recorded as 93 (number of males per 100 females), which improved to 93.5 as per the CIPS 2004.[78] In order to have a better understanding of the situation, one has to study the trends in the sex ratio according to the age of the population. The sex ratio of the ages 0-14 was 105 in 1998, which increased to 106 in 2004. Thus, in the lower age groups, there are more boys than girls, clearly showing the preference for boys as against girls.

A closer look at the provincial distribution of the sex ratio in 1998 suggests that the sex ratio is in favour of women in the adult population, except in the provinces of Koh Kong, Pailin, Mondul Kiri and Oddar Meanchey, where the ratios were 105.1, 117.9, 102.2 and 101.9. In the age groups of 0-14, the sex ratio was in favour of the male population for all provinces in Cambodia (Table 3.34).

Females in the age group 0-4 years were 10.4% of the total female population in 2004, while the percentage of both males and females in the age group 0-4 years was 11.1% of the total population. For females in the age group 5-9 years, these figures change to 11.9% of the total female population, while the percentage of both males and females in the age group

Table 3.34 - Sex Ratio by Province

No	Province	Sex Ratio	
		Total	0-14 yrs
1	Banteay Meanchey	96.24	104.90
2	Battambang	96.06	104.90
3	Kampong Cham	93.12	105.10
4	Kampong Chhnang	89.86	103.20
5	Kampong Speu	92.26	103.60
6	Kampong Thom	92.11	103.90
7	Kampot	91.92	104.80
8	Kandal	92.29	105.00
9	Koh Kong	105.11	105.60
10	Kratie	97.99	104.88
11	Kep	95.68	104.40
12	Pailin	11.786	101.60
13	Sihanoukville	97.70	104.70
14	Mondul Kiri	102.20	103.70
15	Oddar Meanchey	101.97	104.20
16	Phnom Penh	93.05	104.40
17	Pursat	92.18	102.90
18	Preah Vihear	99.01	103.90
19	Prey Veng	88.87	104.10
20	Ratanak Kiri	96.97	103.70
21	Siemreap	93.66	104.30
22	Stung Treng	97.98	105.00
23	Svay Rieng	88.92	104.10
24	Takeo	91.20	105.20
	Total	93.00	104.50

Source: Computed from Census 1998 database.

[78]Royal Government of Cambodia, Ministry of Planning, National Institute of Statistics, "Cambodia Inter-Censal Population Survey- 2004", General Report, Sponsored by UNFPA November 2004.

5-9 years was 12.8% of the total population. This trend of a lower female population continues in the age group 10-14 years also.[79]

3.8 Labour Force Participation of Women and Unpaid Work

The population in the working age group of 15-55 years has grown to about 250,000 young men and women reaching working age every year. (Table 3.35)

The female labour force participation rate, especially in rural Cambodia, increased from 45.51% to 66.8% in 1998 and 2004. The female labour force participation rate for the country, as a whole, increased from 54.6% in 1998, as per the Census, to 64.6% in 2004, as per the CIPS.[80] Strictly speaking, we cannot compare these two sources, since one is a survey and the other is a census.

However, the 2004 data by itself shows that there are more women than men in the labour force in the lower age groups. Participation increased in the age groups such as 14 years and above over the period. Unfortunately, we do not have comparable age group labour force participation rate data for 1998 and 2004. In the older age groups, there are fewer women than men.

1. Unpaid Workers

More often girls and young women are sent to work, while boys and young men have the option to go to school. The larger participation in the labour force indicates that the contribution of women to GDP is higher. Agriculture, forestry and fisheries sectors engaged a majority of women. About 47% of workers in these sectors were women and 29% men. Most of the women were unpaid family workers who did not receive any specific income, except the food and shelter that they shared with their families. The occupational distribution structure indicates that 60.7% of the female workers were reported as unpaid family workers, and 53.1% of male workers were reported as own-account workers. It appeared that most of male heads of the family were reported as own-account workers, and women and children were reported as unpaid family workers.

Some of these own-account workers, as well as unpaid family workers, could be facing a situation of considerable disguised unemployment. Disguised unemployment by definition means that the removal of these workers from family enterprises would not make a difference to the production of the family enterprises. Conceptually, a part of family labour has zero marginal productivity. If women are performing a major part of the work in the family enterprise, then it is the men's work that has zero marginal productivity. However, in the family enterprise, all

Table 3.35 The Growing Labor Force

No	Age Group	Labor Force 1997	Labor Force 2001	Growth (%)
1	15-19	661422	1043163	58
2	20-24	656565	1042364	66
3	25-29	783999	641633	-18
4	30-34	635265	649513	2
5	35-39	579875	636499	10
6	40-44	415995	560277	35
7	45-49	360301	466246	29
8	50-54	286337	385369	35
9	55-59	237141	249580	5
10	60-64	153888	172535	12
11	All groups	4740788	5847179	23

Source: CSES 1997, LFS 2001 UNFPA, Cambodia Annual Report 2004.

[79]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2004.

[80]1998 Population Census of Cambodia www.nis.gov.kh/CENSUSES/Census1998/Labforce.htm

the income of the family is counted against the head of the household as an own-account worker, while the others are reported as unpaid. Women's actual economic contribution and their share of the GDP will become more evident as the number of unpaid family workers is reduced and disguised unemployment is more effectively tackled in rural areas.

As per the data, unpaid family workers in the economy, as a whole, increased from about 41.6% in 1998 to 45.7% in 2004. There was hardly any change in the share of paid employees, which remained around 12% in rural areas. Own-account workers also declined, from 45.3% to 41%. While the situation deteriorated in general, there was not much improvement in the situation of unpaid female workers, as a percentage of total female workers. Unpaid female workers declined marginally by about 1.8%, from 62.5% of the total female workers in 1998 to about 60.7 % of total female workers in 2004. The own-account workers also declined slightly by about 1.24%, from 30.5% to 29.7%. Female paid employment improved from 6.3 % to 9.3%, thanks to the garment industry. The 1998 Census data reveals that the percentage of unpaid women workers to the total female workers was 77.2%. In rural Cambodia, 77.4% of women workers fell into this category. The percentage of paid women employees was 27.9% in urban areas and 25.5% in rural areas (Tables 3.36, 3.37 and 3.38).

2. Wage Employment [81]

There are not many wage employment opportunities for Cambodian men and women. With the garment industry playing a major role in enhancing wage employment opportunities for women, wage employment rates are seen to be increasing among women. There have been less employment opportunities for women in other sectors, such as defence, the police force, education, administration and health, as there are very few women qualified for such positions.

At the same level of education, men and women were not employed in the same kind of job. Women, who had completed only their elementary education found employment as sales workers, street vendors, etc., whereas men with the same educational background, obtained employment as drivers, construction workers, labourers, etc. Thus, men got better-paid jobs than women at all levels of education. At the lower levels of primary and secondary school, the gain in income due to education was low for men. It clearly shows that for women to earn as much as men, they need to be better qualified. The gender gap remains very high in paid employment, in general, though we need more data to statistically prove the point.

As the level of education goes up, the opportunities for employment increase. In white-collar jobs, the proportion of women was higher at 40%, when compared to men at 34%, even though there were more men in this educational group than women. It has also been noted that education increases the earning potential of women. Women with primary education earned 32% more than those who were not educated, which was as low as 10% in the case of men who had primary education as against those who did not. Similarly, women educated to the higher secondary level earned 80% more than women who were not as qualified, whereas men were again lagging behind with a difference of only 42% between those who had secondary education and those who did not.

In conclusion, it appears that women are clearly benefiting from education at the primary and secondary levels in the relatively low paid job market driven by competition, such as in the garment industry and inherently low paid white-collar jobs in the government. However, while more women get jobs, they have to strive harder to attain higher levels of education.

3. Unemployment

The 1998 Census has recorded the unemployment rate as 5.3%. In 2004, it increased to 7.1%. From 1998 to 2004, the labour force between the ages 20 and 24 increased by 66%, and of those aged between 15 and

[81] Royal Government of Cambodia, Ministry of Planning, National Institute of Statistics, "Cambodia Inter-Censal Population Survey- 2004", General Report, Sponsored by UNFPA November 2004.

Table 3.36 - Employment Status by Sex and Occupational Category

No	Employment Status	Cambodia		Urban		Rural	
		Male	Female	Male	Female	Male	Female
1	Employer	0.21	0.10	0.50	0.28	0.15	0.08
2	Paid Employee	18.49	6.30	44.98	22.24	13.45	4.15
3	Self Employed	61.12	30.67	44.65	44.51	64.25	28.81
4	Unpaid Family Worker	19.58	62.87	9.25	32.66	21.54	66.87
5	Other	0.61	0.11	0.62	0.30	0.61	0.09
6	Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: 1998 Population Census; Report 3: Labour Force and Employment

19 increased to 58%. Young people accounted for the majority of unemployment in 2001, with 60% of all unemployed persons and 73% of unemployed males falling in the 15-24 age groups. Unemployment among women was spread over a broader range of age groups but was particularly high in the 15-19 and 35-39 age groups, according to the Labour Force Survey 2001 (LFS). The LFS 2001 survey indicates that the unemployment rate in the age group of 15+ in Cambodia, which was 1.7% overall, was higher among women (2.2%) than among men (1.5%). The reasons for female unemployment could be lack of proper education, and unwillingness to send women elsewhere in search of jobs. Also, the burden of raising a family and the heavy burden of unpaid family work inhibits them from searching for better job opportunities elsewhere. Another reason for the high unemployment rate among women may also be the lack of government support for the development of small enterprises, which are very important for this section of the Cambodian population.

3.9 Female Literacy and Education

The adult female literacy rate was 57% in 1998, and it increased to 64.1% in 2004. Rural female literacy changed from 54.3% to 61.6% over the same period. The percentage of 40% illiteracy for adult rural females is quite large. This low literacy rate among women is due to the fact that more of them work rather than study, as it is considered customary to support the family. Moreover, they bear a heavier burden of unpaid family work, while more men prefer to study in order to find wage employment at higher levels. As has been elaborated earlier, better-educated men and women tend to have higher paid occupations than those who have not completed their education. This is evident in the garment industry where 61% of women workers had completed their elementary schooling and 39% had completed their lower or higher secondary education.

Table 3.37 - Percentage Distribution of Females to Total Employed by Ocupational Category

No	Employment Status	Percent Female		
		Cambodia	Urban	Rural
1	Employer	34.26	30.47	36.4
2	Paid Employee	26.42	27.89	25.46
3	Own Account Worker	34.60	43.82	33.15
4	Unpaid Family Worker	77.18	73.42	77.44
5	Other	16.33	27.76	13.70

Source: 1998 Population Census; Report 3: Labour Force and Employment

Table 3.38 - Occupational Distribution of Workers in 1998 and 2004

Total Cambodia	Both Sexes	Employer	Paid Employee	Own Account Worker	Unpaid Family Worker	Other
Both Sexes						
1998	100	0.15	12.17	45.28	41.57	0.82
2004	100	0.20	12.90	41.00	45.70	0.20
Male						
1998	100	0.21	18.39	60.80	19.48	1.13
2004	100	0.30	16.80	53.10	29.60	0.20
Female						
1998	100	0.10	6.27	30.54	62.55	0.53
2004	100	0.20	9.30	29.70	60.70	0.10

Source: General Population Census of Cambodia,1998. Cambodia Inter-Censal Population Survey, 2004.

The gender gap was more evident in literacy rates at the national level. About 82.1% of males and 67.4% of females were literate in 2004. This is the result of a greater difference in literacy rates at the rural level, where only 65.3% of women are literate compared to 80.8% of men. The overall literacy rate was higher for men than women in all provinces in 1998. The highest literacy rate among women was 78.6% in Phnom Penh; the highest among men at 92.0%, was also in Phnom Penh. The lowest literacy rates for women were recorded in Ratanak Kiri (16.3%), Mondul Kiri (24%), Oddar Meanchey (30.7%), Siemreap (43.1%), Stung Treng (44.5%) and Kep (47.8%) (Tables 3.10 and 3.12 of the section one).

1. Schooling

In 1998, the gender gap was not very large at the primary school level, where 84% of girls and 90% of boys, aged 6 to 11, were enrolled. This gap increased at the lower secondary level, with only 63 girls enrolling for every one hundred boys. In remote areas, however, this gap was wider, with only 67% girls enrolled at the primary level. At the secondary school level, only 1 out of every 6 girls enrolled, compared to 1 out of every 5 boys. However, more recent statistical reports (1998-2002) indicate that there was a 3% increase in the primary level enrolment of girls and enrolment in rural areas went up by 26% in recent years (2001-2002). Lower secondary enrolment for girls from the poorest quintile has also increased to 50%, which was more than that of boys from the richest quintile. There was a clear indication that even though women in Cambodia have an average of three years schooling, the majority of them complete only two years of schooling. Among the youngest age group of women, over half had four or more years of schooling, compared to just over one-fifth of those in the oldest age group (Table 3.39 and 3.40).

The situation further improved in 2004. As per the 2004 CIPS, 80.2% of boys and 81.9% of girls were attending school in 2004. In the age group of 10-14, school attendance went up to 90.9% for boys and 88.9% for girls. However, the attendance rate falls sharply after that age group. For females, school attendance increased by 11.6%, compared to an increase of 8.7% for boys. [82.]

2. School Dropouts

Another concern in this area is that although the enrolment of girls has been increasing, most of them do not remain in school for long. The cases of school dropouts are also increasing, which shows that they do not complete their basic education. The survival and completion rate is very low in the case of girls in Cambodia. In 2001/ 2002, only 61% of girls and 63% of all children enrolled in grade one completed grade six. The overall enrolments accounted for 29% of girls in primary school and 36% in lower secondary school due to late starting ages, repetition, interrupted schooling and drop-out incidents. The incomplete education among large sections of the female population has led to a very low level of women teachers, thus creating a shortage especially in the rural areas. The Pupil Teacher Ratio (PTR) was as high as 56.6 at the primary level.

There was a gaping divide in the higher education rates between the sexes, due to incomplete education in the case of girls. Only recently has women's enrolment increased by 27% in all institutions. Non-formal education, which is a promising area for women to become economically self-sufficient by learning certain traditional skills (hairdressing, weaving, sewing, etc.), is largely ignored and is poorly invested in (3% of the total education investment), which is a matter of immediate concern.

The reason for gender differences in education is believed to be due to a number of factors: the loss of labour at home as girls go to school, girls education being treated as an unwanted economic burden on the family, traditions, early marriage, distance to the school, security and lack of toilet facilities at school (59.5% of primary and 9.8% of upper secondary schools have no toilets). Most importantly, women themselves were reported to discourage their daughters from going to school. The CDHS 2000 confirmed that 59% of women felt that it was better to educate a son than a daughter.

Table 3.39 - Years of Education by Sex and Quintile

Demographic Characteristics		Quintile					Total
		Poorest	2	3	4	Richest	
Years of Education (avg. male age 15+)	1993-94	4.10	4.70	4.80	5.40	6.60	5.10
	1997	3.50	4.10	4.60	5.20	6.20	4.70
Years of education (avg. female age 15+)	1993-94	2.40	2.90	3.00	3.30	4.30	3.20
	1997	2.10	2.40	2.80	3.30	4.10	3.00

Source: Ministry of Planning, "Poverty Profile of Cambodia, 1997".

Table 3.40 - Number of Years of Schooling of Girls by Age Group

Age	Years of Schooling				Total %
	0	1 - 3	4 - 6	7+	
15-19	19.70	23.00	33.80	23.40	100.00
20-24	23.00	26.20	29.20	21.70	100.00
25-29	21.50	25.80	28.00	24.70	100.00
30-34	30.30	33.70	21.80	14.20	100.00
35-39	38.60	39.90	15.30	6.20	100.00
40-44	30.60	38.00	20.50	10.90	100.00
45-49	41.40	35.10	15.90	7.60	100.00

Source: National Institute of Public Health, "National Health Survey, 1998".

[82]Royal Government of Cambodia, Ministry of Planning, National Institute of Statistics, "Cambodia Inter-Censal population Survey- 2004", General report, Sponsored by UNFPA November 2004.

3.10 Women in Agriculture[83]

Almost 54% of the workforce in market-oriented agriculture and 56% in subsistence agriculture are women. The feminisation of agriculture is largely due to the increasing migration of men. However, the access to resources is limited for women. When it comes to the land rights of women in Cambodia, this too has the reflections of power-based gender relations in Cambodian culture and tradition, where only men are given the right to inherit land, even in case of death, divorce or family break-up. The problem of landlessness is more intense for women in Cambodia.

As has already been mentioned, the Land Liberalization Act of 1989 had a discriminatory impact on women's land rights, especially on female or war widow- headed households, as distribution was based on the size of the family. Such families were left with a small area of land insufficient to grow enough food. An example of this can be found in the Oxfam survey, which indicates that 84% of widows with land owned less than half a hectare. This had forced them into indebtedness and, finally, landlessness. The Oxfam GB survey reported that one out of five women-headed families were landless, the most affected being those headed by war widows, with 21% landless.

The new Land Law passed in 2001 has brought out measures to ensure equal rights over land to both men and women. This was followed by the issuance of some 80,000 new titles, of which 78% were for both men and women together. However, women are still unable to enjoy this right fully due to continued male domination, as well as weak enforcement and customary practices.

Constraints to higher earnings by women in agriculture

Women are not able to realise their full potential because of certain inherent disadvantages, such as poor infrastructure that inhibit them from having access to the market, and inaccessibility to credit-based facilities, technology and market information, due to poor communications. When it comes to agriculture and rural livelihood-related services or extension services, women gain almost nothing from them. Only 5-10% of agricultural extension agents are women. The reasons for this include: agriculture research and extension not focusing on women, lack of mobility, the problem of communication between men and women inhibiting transfer of knowledge, and, lastly, the illiteracy of the target group.

Technology [84]

Compared to other rural women in the region, Cambodian women have a higher decision-making power in agriculture-related activities. But the technology used by women in agriculture is outdated due to the inaccessibility to agricultural loans and credits and lack of knowledge. FAO case studies of four villages in Cambodia show that most of these women had no idea about the use of pesticides and fertilizers. They still followed the old method of catching insects by nets and burning, which was not very effective. Except for tractors and power tillers, which were used by men, there was little difference between the tools men and women used. The use of sickles, pump sets, sprayer, etc. clearly indicated that agriculture was still labour intensive and generally manual, even with the help of tools and machinery. Most of the women's knowledge was derived from what they had been taught by their parents. Technology transfer to women will become important in the years to come as Cambodian agriculture modernises and men move out of family farms.

3.11 Women in Industry[85]

The employment trends of women in industry can be studied mainly by looking at the garment sector. Only 31% of women hold wage employment in other industries, while they are the majority in the garment industry. Women comprise more than half of the workforce in the food-processing industry and an

[83]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2004 & June 2004.

[84]Food and Agricultural Organization (FAO) "Women's Technology Use and Demand in 4 Villages in Cambodia" A Report.

estimated 75% of workers in handicrafts and other traditional industries are women.

The garment sector currently has 180,000 women workers employed in 200 garment factories in Cambodia. The garment sector has created employment opportunities for Cambodian women since the mid-nineties. Previously only men used to migrate in search of paid employment to urban areas, while women were deprived of this privilege. The opportunities provided by the garment industries clearly challenged this practice. The garment industry is also responsible for the empowerment of young women through labour unions. Most of the women employed here are educated, which is evident from the fact that 61% of them had completed their elementary schooling and 39% of them had completed their lower or higher secondary education. Preference for women, especially young women in this sector, is due to the fact that they are cheaper to hire than men and are also more skilled and can also be easily exploited to extract more work.

The garment sector in Cambodia has undergone a tremendous improvement since 1997 after it was given Most Favoured Nation Status by the European Union and the United States and was further enhanced after it entered a quota agreement with the United States on garment exports in 1999 (later extended to 2004). It now provides 20% of total wage employment and is responsible for 94% of the growth of the industrial sector. The future of the garment industry is uncertain, but Cambodia still appears to enjoy an advantage compared to some of its competitors, due to its higher labour standards.

Women's wages in paid employment

Wages are discriminatory to women in general in industry. On average, it has been calculated that men's wages are 33% higher than women's. The largest difference (75%) has been recorded among the men and women labourers between the ages 15 and 19 years with no schooling, but the difference goes down as the age level goes up to 30-39 years with higher secondary schooling. The participatory poverty assessment states that it was very common for women to be paid less for the same work, wherever there was limited wage employment. Women received 2,500 Riels per day, compared to men who received 5,000 Riels for the same work.

As the education level goes up, wage differentials are less. Compared to a man without any schooling, a man with an elementary education received 10% more in wages, whereas in the case of women the difference was 32%. At the upper and post secondary education levels, the difference increased, reaching 42% for men and 80% for women, when compared to those without any schooling.

3.12 Female-Headed Households

According to the 1998 Census, female-headed households comprised 25.7% of the total households.[86] This number is said to have increased to 29%, according to the CIPS 2004.[87]Most of the women heading these households were the women widowed during internal and external conflicts. The families of these missing men were left dependent on their widowed wives, who took care of livelihoods and fed the family. This was particularly noticeable in a few villages where one could hardly find men between the ages of 15 and 50 years. Apart from those who were widowed, the unmarried women before the Khmer regime, never got married and continued to support their families. The most commonly cited figures in the early 1990s were that 64% of the adult population was female, while women headed 35% of the households nationwide. In 1992, it was found that the female-headed households comprised 25% of households in certain areas. In other parts of the country, which were particularly devastated by fighting, the rates were higher. In the wet rice-growing area, where some research was conducted, widows headed 41% of the households. Other studies have noted that it was not rare to find villages where the figure was 50%.[88] The present increase in the number of these households can be attributed to the migration of men in search of better employment opportunities to other provinces and to the neighbouring countries of Lao PDR,

[85]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2004.

Thailand and Vietnam. These countries encourage migrant labourers from Cambodia, as they are a cheaper labour option in comparison to the indigenous labour force.

The National Institute of Statistics' 1998 data, on female-headed households in the various provinces of Cambodia indicate that the highest percentage of such households was in Pailin (32.5%). This may be because of the low migration among women, which was just 0.2% of the total. A similar trend was found in Prey Veng, where the female-headed households was at 31.2% despite the higher migration rate among women (12.1%) over men (12.0%). Similar cases were also found in Battambang, Kampong Thom and Svay Rieng where female-headed households are 29%, 28.8% and 27.5% respectively. The migration among females was more here than that of men, which was about 7.5%, 4.4% and 5.1%, respectively.

The higher number of female-headed households, irrespective of the higher outward migration of women in these areas, could be due to the sex ratio tilting in their favour, except in Pailin. It could also be due to the migration of women in the young age groups, while the older women stayed at home to take care of their families. Phnom Penh is an exception, where the number of male migrants was more (8.5%) than the female migrants (6.9%). This is also reflected in the number of female-headed households at 28.7%. In the areas where the migration of women is high, literacy rates were more than 50%. Higher literacy rates encourage migration in search of better livelihoods.

The lowest percentage of female-headed households was found in the provinces of Stung Treng at 16.8% and Ratanak Kiri with just 12.5%. In Stung Treng, the migration figures were very low, probably due to low literacy rates. The low migration figures denote that more men stay at home, which is why the households headed by females were low in number. In Ratanak Kiri also, the migration amongst both men and women was very low (men 0.23% and women 0.20%), which could be due to the low male and female literacy rates recorded, at 38.9% and 16.3%, respectively, which in turn, were the lowest among all other provinces. There could be other reasons for the low percentage of female-headed households in these provinces, some of which may be historical. Two other provinces falling into this category of low percentage of female-headed households were Preah Vihear (18.7%) and Kratie (18.3%). In the CSES 2004 survey of 9,000 households, the lowest number of female-headed households was recorded in Preah Vihear (11%) and Prey Veng (11%) and the highest in Svay Rieng (27.9%) and Phnom Penh (27.7%). (Tables 3.41, 3.42 and 3.43).

Gender and Health [89]

In Cambodia, providing health services to people is the greatest challenge for the government. The life expectancy is 54.5 years for men and 58.3 years for women. Low life expectancy is due to the lack of basic medical care, the high occurrence of preventable diseases like malaria and tuberculosis, as well as high infant and maternal mortality rates. The health care crisis in some areas appears to have had a crippling impact on families causing them to fall into debt. About 46% of people who had recently lost their lands were those incurring very high health care expenditures (Oxfam Cambodia).

The health condition of women is poor in Cambodia as most of them are vulnerable to reproductive health problems and malnutrition. Poor access to health services among women is said to be partly due to lack of education and awareness. Poverty and unaffordability seem to be the main reasons. As per the CDHS 2000, however, 95% of women surveyed

[86]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2004.

[87]Royal Government of Cambodia, Ministry of Planning, National Institute of Statistics, "Cambodia Inter-Censal population Survey- 2004", General report, Sponsored by UNFPA November 2004.

[88]"Women in Cambodian Society" http://www.seasite.niu.edu/khmer/Ledgerwood/women.htm.

Table 3.41 - Male and Female-Headed Households by Province, 2004

No		Province	Heads of Households %	
			Male	Female
1	p	Banteay Meanchey	78.40	21.60
2	p	Battambang	71.00	29.00
3	p	Kampong Cham	78.30	21.70
4	p	Kampong Chhnang	74.40	26.80
5	p	Kampong Speu	74.40	25.60
6	p	Kampong Thom	71.20	28.80
7	p	Kampot	73.50	24.50
8	p	Kandal	74.60	25.40
9	p	Koh Kong	74.70	25.30
10	p	Kratie	81.30	18.30
11	m	Kep	73.20	26.80
12	m	Pailin	67.50	32.50
13	m	Sihanoukville	77.50	22.50
14	p	Mondul Kiri	78.00	22.00
15	p	Oddar Meanchey	76.90	23.10
16	m	Phnom Penh	71.30	28.70
17	p	Pursat	75.80	24.20
18	p	Preah Vihear	81.30	18.70
19	p	Prey Veng	68.80	31.20
20	p	Ratanak Kiri	87.50	12.50
21	p	Siemreap	72.40	27.60
22	p	Stung Treng	83.20	16.80
23	p	Svay Rieng	72.50	27.50
24	p	Takeo	73.50	26.50

Source: Computed from CSES 2004 database.

noted that they had some problem or the other in accessing medical care, the most common being poverty (88%), whereas some complained of transportation problems (40%).

The maternal mortality rate was 437 out of 100,000, although new data would seem to indicate an improvement in the situation. Every year an estimated 2,000 Cambodian women die at childbirth and another 200,000 have their health seriously and adversely affected due to pregnancy. Half of all women receive no postnatal care following delivery. Only 28% receive antenatal care and skilled birth attendants attend the delivery of only 32% of total deliveries. A shortage of birth assistance personnel and poor distribution of health services has been recorded. The number of midwives and nurses seems to have fallen by 8.4% over the past five years. Out of these, many were unable to reach remote areas due to distance and lack of funds for transportation and equipment. Women, mostly in rural areas, chose to deliver at home due to financial constraints and poor transportation facilities. The number of antenatal care visits by Cambodian women shows that more than half of them did not have access to the service (Table 3.44). Malnutrition was also a problem. Twenty-two per cent of women in rural areas were underweight and suffered from chronic energy deficiency, and 58% of women, aged 15-49, and 65% of pregnant women suffered from iron deficiency. These are clear indicators of chronic nutritional insecurity among this section of the population.

[89]Ministry of Women's Affairs in collaboration with UNIFEM, World Bank, ADB, UNDP & DFID/UK'A Fair Share for Women' Cambodia Gender Assessment, Phnom Penh, April 2004 and June 2004

Table 3.42 - Male and Female-Headed Households by Province, 2004 (Survey 9000 Households)

No	Province	Headed HH by Sex				Total	
		No. of Sample HH		%		No. of Sample HH	%
		Male	Female	Male	Female		
1	Banteay Meanchey	379	101	78.96	21.04	480	100
2	Battambang	495	172	74.21	25.79	667	100
3	Kampong Cham	941	259	78.42	21.58	1200	100
4	Kampong Chhnang	243	67	78.39	21.61	310	100
5	Kampong Speu	378	101	78.91	21.09	479	100
6	Kampong Thom	371	89	80.65	19.35	460	100
7	Kampot	325	93	77.75	22.25	418	100
8	Kandal	594	185	76.25	23.75	779	100
9	Koh Kong	65	15	81.25	18.75	80	100
10	Kratie	234	45	83.87	16.13	279	100
11	Mondul Kiri	23	7	76.67	23.33	30	100
12	Phnom Penh	604	231	72.34	27.66	835	100
13	Preah Vihear	89	11	89.00	11.00	100	100
14	Prey Veng	89	11	89.00	23.57	100	100
15	Pursat	214	66	76.43	23.57	280	100
16	Ratanak Kiri	80	10	88.89	11.11	90	100
17	Siemreap	456	134	77.29	22.71	590	100
18	Sihanoukville	52	18	74.29	25.71	70	100
19	Stung Treng	70	10	87.50	12.50	80	100
20	Svay Rieng	274	106	72.11	27.89	380	100
21	Takeo	503	127	79.84	20.16	630	100
22	Oddar Meanchey	19	1	95.00	5.00	20	100
23	Kep	27	3	90.00	10.00	30	100
24	Pailin	35	5	87.50	12.50	40	100

Source: Computed from CSES 2004 database.

Table 3.43 - Male and Female Migrants (%)

No	Province	Total Male Migrants	Total Female Migrants	% of Male Migrants to Total Male Migrants	% of Female Migrants to Total Female Migrants
1	Banteay Meanchey	2896	2468	3.34	2.98
2	Battambang	6477	6225	7.46	7.52
3	Kampong Cham	13035	12783	15.01	15.44
4	Kampong Chhnang	2132	1730	2.46	2.09
5	Kampong Speu	4964	5094	5.72	6.15
6	Kampong Thom	3524	3654	4.06	4.41
7	Kampot	4155	4271	4.79	5.16
8	Kandal	9201	9741	10.60	11.76
9	Koh Kong	881	842	1.01	1.02
10	Kratie	1234	1119	1.42	1.35
11	Mondul Kiri	168	121	0.19	0.15
12	Phnom Penh	7372	5704	8.49	6.89
13	Preah Vihear	368	238	0.42	0.29
14	Prey Veng	10417	10020	12.00	12.10
15	Pursat	2392	2510	2.75	3.03
16	Ratanak Kiri	198	169	0.23	0.20
17	Siemreap	3442	2467	3.96	2.98
18	Sihanoukville	1406	1199	1.62	1.45
19	Stung Treng	352	248	0.41	0.30
20	Svay Rieng	4260	4200	4.91	5.07
21	Takeo	7044	7218	8.11	8.72
22	Oddar Meanchey	602	537	0.69	0.65
23	Kep	129	71	0.15	0.09
24	Pailin	176	172	0.20	0.21
	Cambodia Total	86827	82801		

Source: Computed from CSES 2004 database.

Table 3.44 - % of Distribution of Live Births by Antenatal Care Visits (last 5 years)

No	No of Visits	% Distribution
1	None	54.50
2	One Visit	15.00
3	2-3 Visits	22.60
4	4 or More Visits	5.50
5	Unknow/Missing	2.40
6	Total	100.00
	Median No. of Visits (for those with ANC)	2.00

Source: National Institute of Public Health, "National Health Survey, 1998".

CHAPTER - 4

Food Absorption

CHAPTER 4

Food Absorption and Nutritional Security

Even if a person has access to sufficient, as well as nutritious food, there is no guarantee that she or he will lead a long and healthy life. For a long and healthy life, there are two prerequisites other than the nutritional needs for the body. The first is safe drinking water and a pollution-free environment, including sanitation, so that people can be protected from disease. The second is access to, and affordability of a good health care system.

Health care refers to those services that are provided to individuals or communities through health organisations or professions. The aim of health care is to enhance, maintain, restore and monitor health. It is not limited to medical care offered by physicians, but includes care given by many other related professionals. Primary health care includes outpatient medical help and public health aspects, such as immunization, prenatal and postnatal care, as well as assistance during child birth. Secondary health care refers to the care to which patients do not have direct access, they must be referred to it from some other parts of the health system. Health centre specialist services, including hospitalisation, fall under this category. The number of hospital beds, specialist doctors and specialist hospitals determines the secondary health services available to people. The combination of all of these services, to an adequate degree, would result in a healthy population.

In this chapter, we first study the population characteristics that have a bearing on the health status of the population. Second, we study the prerequisites for nutritional security, such as safe drinking water, sanitation, and primary health care. The third issue is concerned with the expected outcomes of nutritional security, such as underweight, stunting and wasting in children, as well as body mass index in adults. Lastly the data from demographic health surveys have been analysed to study the factors that lead to underweight children.

4.1 Population

A brief account of the age and sex composition of the population reveals that the priority areas for nutritional security need to be children, women, the old and the infirm. The population falling under the above four categories requires more affordable health care. In a population, if there are more women than men and more persons in the younger and older age groups, it not only increases the dependency burden of the nation, but also increases the health care burden substantially. This has to be borne in mind while assessing health care investments. The dependency ratio in 2004 was 74% which, due to a fall in the child population, was lower than the dependency burden in 1998 (Table 4.1).

Like other developing countries of Asia, Cambodia has had high population growth rates and high fertility rates. Hence, the country has an age composition that is tilted towards the younger age groups. It has a broad-based pyramid structure, as the majority of the population is under the age of 20. Above

the age of 25 years, the pyramid follows the usual pattern with decreasing numbers as age increases.

Table 4.1 - Dependency Ratio

	Total	Urban	Rural
Both Sexes	74.00	59.70	76.80
Male	79.80	64.90	82.80
Female	68.80	55.10	71.50

Source: Cambodia Inter-Censal Population Survey 2004, General Report.

The annual compound rate of growth of the population was estimated to be 2.4% in 1998. In 2004, as per the CIPS, the annual compound population growth rate of the population, between 1998 and 2004, was estimated at 1.8%. Thus, the growth rate of the Cambodian population has signifcantly slowed. One reason could be falling birth rates, a second could be a decline in the number of people returning from neighbouring countries and a third could be the migration of men and women to neighbouring countries for work opportunities. The net addition of people may have declined.

Table 4.2 - Distribution of Population by Age Groups

		% of Population	
Age Group	1998 Census	CIPS 2004	Population Projection for 2004
0-14	42.80	38.60	38.80
15-49	46.90	49.50	50.40
50-64	6.80	8.00	7.20
65+	3.50	3.90	3.60

Source: Cambodia Inter-Censal Population Survey 2004, General Report.

In 1998, 42.8% of the population was in the age group of 0-14 years, which has come down to 38.6% according to the 2004 data. The proportion of children (0-14 years) has declined in the total population by about 4.0%. The proportion of children in the age group of 0-4 declined from 12.8%, in 1998, to 11.1% in 2004, showing a decline in fertility rates. The percentage of population above the age of 65 increased from 3.5% to 3.9%, as addition to the older age group was lower than the addition to the younger age groups. The median age in Cambodia in 2004 was 19.9 (Table 4.2).

As a consequence of the high levels of male mortality in the 1970s, the female to male ratio was higher than usual. Below the age of 35 years, there was an unusual gap in the pyramid structure for the age groups 20-24 and 25-29. These two age groups were smaller than those above and below. The past internal conflict was probably responsible for such an unusual gap. Few births and probably very high infant and child mortality characterised this era. The most recent period, consisting of the years 1995 to 2000, reflected a decline in fertility. It also illustrated an increase in infant mortality. The reduction in the population in this last five-year period could have been due to generational effect of the population gap. There were fewer women entering the reproductive stage of their lives in the age group of 20-24. Therefore, fewer children were born than in the previous periods.

Fertility Rates

The national Total Fertility Rate (TFR), as per the 1998 Census, was 4.1 births per woman. In urban areas, the TFR was 3.3 births per woman, one child lower than the rate in rural areas, which was 4.3 births per woman. The average Cambodian woman begins childbearing around the age of 20, and if current age-specific fertility rates remain unchanged, she will have 4.1 children during her lifetime. Data from CIPS 2004 indicates a reduction in the TFR to 3.23.

Sex Ratio

Females outnumbered males both in the rural and urban areas of Cambodia. The sex ratio is defined in this report as the number of males per 100 females. If the sex ratio exceeds 100, it means that males outnumber females; however, if the sex ratio is below 100, it means that females outnumber males. The sex ratio in the population as a whole in 1998 was only 93.0 males per 100 females. Among persons aged 20 years and older, the sex ratio was 82.3 and among those aged 60 years and older it was only 71.8. Obviously, the sex ratio of older persons was more skewed. With a return to relatively stable political and social conditions, a baby boom occurred in Cambodia during the 1980s and the sex ratio seemed to return to normal.

Table 4.3 - Sex Ratio by Age Groups, 1998 and 2004

Age Group	Sex Ratio	
	1998 Census	CIPS 2004
0-14	104.50	106.10
15-49	88.10	90.70
50-64	74.00	71.30
65+	71.10	67.60

Source: Cambodia Inter-Censal Population Survey 2004, General Report.

For the country as a whole, as per the CIPS of 2004, the sex ratio was in favour of women at 93.5 males for 100 females. The position of males improved compared to the 1998 situation. The adverse sex ratio for women in the 0-14 group, in favour of males, however, reflected the normal preference of Cambodians for boys as against girls (Table 4.3).

4.2 Prerequisites for a Healthy Population

Safe Drinking Water

In rural areas, fewer people have access to safe drinking water and sanitation facilities.[90] Though groundwater resources are available, access to potable water is limited. Some studies have shown that people in rural areas mostly obtain their drinking water from rainwater in the rainy season and from ponds or rivers in the dry season. Few people use drinking water from community boreholes, because groundwater is believed to contain excess minerals (calcium carbonate, iron, manganese and even arsenic), and many are out of service because of lack of appropriate maintenance.[91]

In 1998, about 29% of the population had access to safe drinking water. Among the provinces, Phnom Penh had the highest percentage of population (85.4%) with access to safe drinking water. As Phnom Penh is urbanised, this is to be expected. The next highest was Prey Veng, with only 54.5% of the population having access to safe drinking water, which is low when compared to Phnom Penh. Other provinces, such as Oddar Meanchey and Kampong Thom, had only around 3% of the population with access to safe drinking water as per the 1998 Census (Table 4. 4) (Map 4.1). In the regional districts, water was obtained from wells (71.7%), ponds (27%), canals (0.9%) and rivers (0.2%), or rainwater was collected and stored.[92]

The Royal Government of Cambodia has supported an increase in water supply in recent years by setting up small-scale irrigation facilities. Water has been made available for household use, rice production and to supply safe drinking water to the population in rural areas. Thus, the situation has improved substantially over time. The CIPS showed that, in 2004, about 44% of households had access to safe drinking water, as against 29% in 1998.[93] Further, the main sources of

[90] Council for Social Development "National Poverty Reduction Strategy 2003-2005" Kingdom of Cambodia 20th December 2002.

[91] Mahe, J.P, Monvois, J and Malafosse, A "MIREP: An Innovative Approach to Private Participation in Rural Water Infrastructure" Paper presented in 30th WEDC International Conference, Vientiane, Lao PDR, 2004

[92] Japan Overseas Development Agency for the Kingdom of Cambodia, "Country side" A Report.

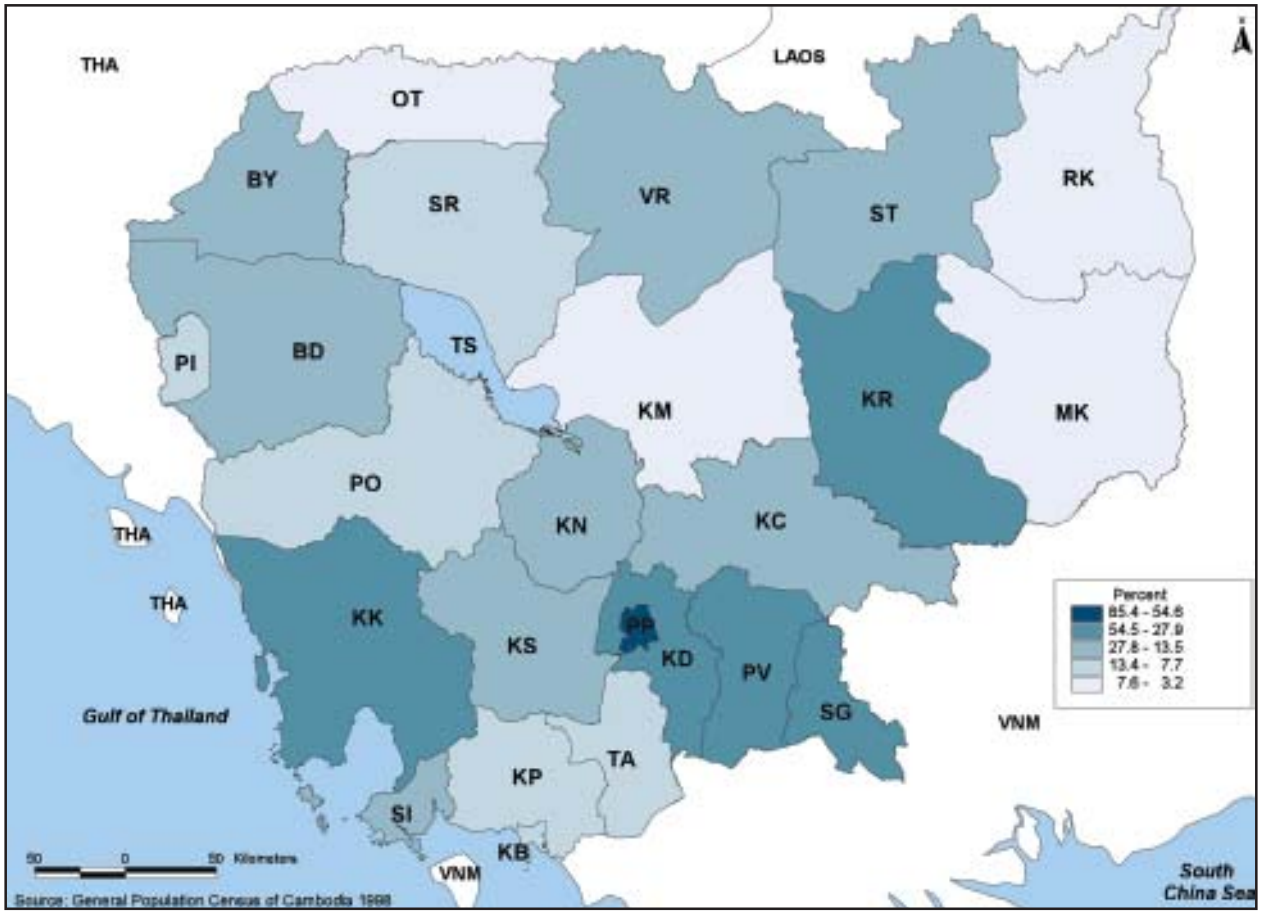
[93] Royal Government of Cambodia, Ministry of Planning, National Institute of Statistics, "Cambodia Inter-Censal Population. Survey- 2004", General Report, Sponsored by UNFPA November 2004.

Table 4.4 - Infant Mortality Rate, Population with Access to Safe Drinking Water and Sanitation by Province

			1	2	3
No		Province/Municipality	% of Population Having Access to Safe Drinking Water	% of Population Having Access to Sanisation	Infant Mortality Rate
1	p	Banteay Meanchey	19.20	10.40	78.20
2	p	Battambang	21.70	19.90	98.00
3	p	Kampong Cham	19.40	9.70	107.90
4	p	Kampong Chhnang	19.30	6.00	129.30
5	p	Kampong Speu	22.40	3.90	68.30
6	p	Kampong Thom	3.60	13.10	64.50
7	p	Kampot	13.20	8.00	100.40
8	p	Kandal	36.30	12.30	89.20
9	p	Koh Kong	36.40	14.70	70.70
10	p	Kratie	32.80	13.40	71.30
11	m	Kep	12.40	3.30	100.40
12	m	Pailin	13.10	19.80	98.00
13	m	Sihanoukville	27.80	25.20	100.40
14	p	Mondul Kiri	7.60	11.40	169.80
15	p	Oddar Meanchey	3.20	2.00	77.90
16	m	Phnom Penh	85.40	74.90	37.60
17	p	Pursat	12.30	8.50	139.40
18	p	Preah Vihear	17.70	4.90	71.30
19	p	Prey Veng	54.50	4.30	111.00
20	p	Ratanak Kiri	5.50	9.20	169.80
21	p	Siemreap	13.40	6.60	77.90
22	p	Stung Treng	19.20	13.80	71.30
23	p	Svay Rieng	48.20	8.20	102.00
24	p	Takeo	12.90	4.30	96.00

Source: Column 1 & 2, General Population Census of Cambodia, 1998; Column 3, Cambodia Demographic and Health Survey (CDHS), 2000.

Map 4.1 - PERCENTAGE OF POPULATION WITH ACCESS TO SAFE DRINKING WATER



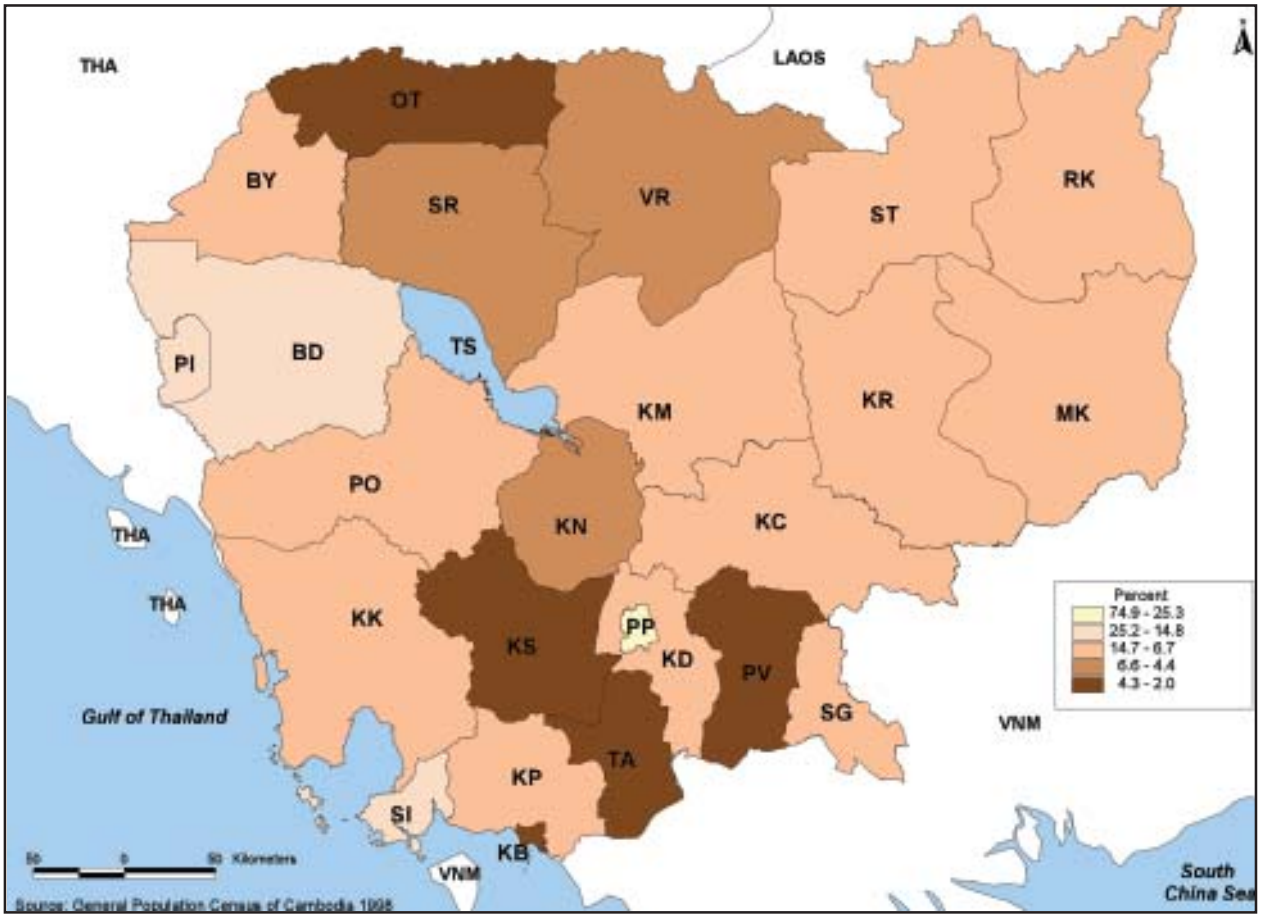
safe and protected drinking water in Cambodia were tube wells, piped supply and protected dug wells. The rural population depended upon spring and river water for 30% of their drinking water supply and unprotected dug-wells for about 29% of the total drinking water supply. About 33% of rural households used protected water sources such as piped water, tube wells and protected dug wells.

The situation has improved even for the poorest. For the poorest 20% of the rural population in 1998, the percentage with access to safe drinking water was only 4%. CDHS 2000 data showed that 54% of the poor rural households rely on pumps or wells as a source for water supply. The demand for safe water at home is increasing among those living in rural areas. More and more people are ready to pay for such services. As a result, small private piped water systems have appeared in rural areas. However, those services are often limited to commercial areas of big villages and the quality of water and service vary greatly.[94] Although a water supply system exists in the city of Phnom Penh, it is not considered safe, by some, and people purchase bottled water for drinking.

[94] Mahe, J.P, Monvois, J and Malafosse, A "MIREP: An Innovative Approach to Private Participation in Rural Water Infrastructure" Paper presented in 30th WEDC International Conference, Vientiane, Lao PDR, 2004

[95] United Nations Children's Fund (UNICEF) "The State of World's Children" New York, 2000.

Map 4.2 - PERCENTAGE OF POPULATION WITH ACCESS TO SANITATION



Sanitation

The proportion of population with access to adequate sanitary facilities was 19% nationwide (57% for urban areas and 9% for rural areas).[95] As far as the sewage system is concerned, it is available only in urban areas. Even medical facilities rarely have a sewage system, and they resort to dumping human waste in rivers. Garbage is collected by trucks in the city of Phnom Penh, but is often scavenged beforehand by other residents. There are hardly any appropriate incinerators for medical facilities, thus the disposal of medical wastes in Phnom Penh also relies on the general garbage collection system. Garbage is often seen scattered on the ground in local districts. Regarding food sanitation, some laboratories or aid groups sporadically perform tests, but there is no established system for the management and testing of food products. Very little information is available about food safety and contamination.

The percentage of the population having access to sanitation facilities was the highest in Phnom Penh with 74.9%; the next highest was Sihanoukville with 25.2%. Other provinces, such as Battambang, Pailin and Koh Kong had some access to sanitation facilities with 19.9%, 19.8% and 14.7%, respectively. The lowest percentage of the population having access to sanitation facilities was in Oddar Meanchey with 2% (Table 4.4) (Map 4.2).

As per the CIPS 2004, there has been a modest improvement in sanitation facilities. The households having toilet facilities within their premises increased from 14.5% in 1998 to 21.9%. In urban areas, households with toilet facilities increased to 55%. In rural areas, the facilities doubled, from 8.6% to 16.4%.

4.3 The Health Care System

The new government is committed to improving health care facilities by re-establishing and decentralising the health care system. The government has acknowledged the importance of both public and private health care services and has pledged to regulate and improve the quality of care in both. The health care system is structured in three main levels:

*Community level: Health Centres (nurses, midwives, lab-technicians); at the community level, there are also Traditional Birth Attendants (TBAs), traditional healers or Kruu Khmer and volunteer health workers. Traditional healers are not paid by the government;

*Referral Hospital (nurses, midwives, physicians and medical assistants);

*National Hospital (nurses, midwives, physicians and medical assistants).

As of 1999, there were 929 health centres and 62 referral hospitals. In the capital city of Phnom Penh there were 6 main hospitals. Each health centre covered from 5,000 to 12,000 inhabitants. The number of beds nationwide was low at 6,516 (approximately 57 beds per population of 100,000), while the percentage of beds occupied was 48.8%. The average period of hospitalisation was 4.75 days.[96]

The under-utilisation of the health care system could also be due to unaffordability of the health care provided, as health care in the country is not free. Expenditure on health is high, and for poorer households with little spare cash or savings, illness is catastrophic. The CSES 1997 reported that expenditure on health accounted for about 5% of rural expenditure; in addition, about 10% of the associated costs (such as transport) was health-related. Quality health care is scarce, and public confidence in the system is low. In 1995, the government per capita spending on health was US$2.0. In 1997, only 5.7% of public spending was for health. Poor living conditions, poor hygiene, large families and food shortages worsen nutritional security. Limited access to quality health care worsens the situation. Illiteracy and poor knowledge of health and hygiene prevent people from coping with illness.[97] Another survey found health expenditure to be as high as 20% of total household expenditure.[98] Disaggregated statistics show no significant gender differentials for treatment of 'major illness' in terms of the cost per visit. Forty-five per cent of health costs were funded by loans from moneylenders (Ministry of Health 1997). The first choice for both rural and urban patients was the pharmacist, followed by private doctors and clinics (MoP 1998). The CSES 1996 found that 35% of treatment was provided by a parent or relative, with this figure rising to 71% in remote provinces. Health centre staff provided only 16% of treatment. The home was perceived as the safest place for health care.

The hospitalisation facilities at health centres are usually limited to two beds. Many health centres have recently been rebuilt, making them cleaner than their supervising district level referral hospital. The district level referral hospitals usually have about 50 beds, but no operating room, and use electricity supplied by a generator. Tests and treatments requiring electricity are generally not performed. Except for the tuberculosis wards, where the patients can receive medication and

[96] Royal Government of Cambodia, Ministry of Health, Department of Planning and Health Information "National Health Statistics Report - 1998" Phnom Penh, 1999

[97] Paper for the Conference "Expanding Access: Advancing the Roles of Mid-level Providers in Menstrual Regulation and Elective Abortion Care" South Africa, 2 - 6 December 2001. http://www.ipasihcar.net/expacc/reports/CambCR.html

[98] Japan International Cooperation Agency "Reconstruction to Sustainable Development" Kingdom of Cambodia, March 2002.

rice free of charge, hospitalisation of patients is rare. Provincial hospitals are generally designed in a pavilion form, where the wards are interspersed throughout a large hospital lot, and a health centre is provided in the form of an outpatient division.

Many of the provincial hospitals, district level referral hospitals and health centres are extremely old and worn out, occasionally with leaky roofs. Renovation and repair work financed by overseas aid is being carried out. Only two known CT scanners are available in Cambodia, while laparoscopy and dialysis are not available. Moreover, the number of facilities capable of using endoscopes and respirators is limited.

In Cambodia, the basic elements of a potentially effective public health system are already in place, but there is still a mismatch between the needs of the population and the ability of the health services to meet them. The public health system is generally under-utilised. In addition to the unaffordability of health care, due to poverty, other limiting factors have been listed by some international agencies. The under-utilisation of health care can also be accounted for by popular beliefs and misconceptions about health and the question of where to seek effective assistance for health problems. The challenge is to make the right match between the needs of the population and health service provision. Health Net International is applying anthropological methods to try to understand people's current health care-seeking behaviour, and to develop an effective means of communicating with them about health and health care issues.[99]

Reproductive Health Care Services

Reproductive health care is supposed to be provided at all levels of public health services. The health centres provide birth spacing counselling and distribute pills, condoms and injections. According to the Safe Motherhood Clinical Management Protocol for the Health Centre Level, midwives and other providers should follow a set of procedures. It is not clear whether such protocols are followed.

Maternal and Child Health Services

Maternal mortality is said to be a leading cause of death in Cambodia.[100] A woman's nutritional status has a direct bearing on her chances of surviving pregnancy and on the child's likelihood of leading a healthy life. Calorie, vitamin, mineral and protein requirements increase markedly during pregnancy. Women in resource-poor settings, and those with little access to health care, may be unable to meet their increased dietary requirements. Hence, antenatal care becomes important.

For the majority of live births (54.5%) in the last five years, the mother did not receive any antenatal care at all. For the minority who did get care, most did so only late in pregnancy: the median stage of pregnancy at the first antenatal visit was at a gestation of 6 months. The location where mothers live, their socio-economic status, the number of years of schooling they have had and their level of literacy – all have a very strong relationship with the receipt of antenatal care, in general, and also (for those receiving antenatal care) with the type of provider. In the capital city, 81.3% of births in the last five years had received antenatal care. In contrast, among women living in remote or isolated provinces, less than 40% of births were preceded by any antenatal care – a more than twofold difference.

Most births in Cambodia (89%) took place outside of the health facilities. The proportion of births delivered in a health facility was low in all regions, at around 14% or less, except in Phnom Penh, where it was 71%. The lowest number of births in health facilities

[99] Royal Government of Cambodia, Ministry of Health, 1997 http://www.healthnetinternational.org/EN/CORE/00/02/80.HTML

[100] Population Reference Bureau www.pbr.org

[101] National Institute of Statistics and Planning and Directorate General for Health (Cambodia) and ORC Macro, Calverton, Mary land, USA, " Cambodia Demographic Health Surveys" 2000.

[102] National Institute of Statistics and Planning and Directorate General for ORC Macro, Calverton, Mary land, USA, "Cambodia Demographic Health Surveys" 2000

occurred in Siemreap, Oddar Meanchey and Prey Veng (2%).[101] Births at home can be safe, provided a woman's family and attendants can recognise the signs of complications and, if complications occur, are able move her to a facility where trained professionals can provide care.

Nutrition to Infants and Children

Breast-Feeding [102]

Although breast-feeding is nearly universal, its onset in Cambodia is typically delayed. Very few infants are breast-fed within an hour of birth (11% in 2000); half of infants did not begin even within the first day (only 24% within 24 hours in 2000) and 57% of the newborn infants received pre-lacteal feedings (CDHS, 2000).[103]This meant that the infant was not only denied the protective effects of colostrum, but was also unnecessarily exposed to pathogens through the consumption of other fluids. The average duration of breast-feeding in Cambodia has been recorded as 24 months. Exclusive breast-feeding (with no introduction of other foods) was being practised by 14% mothers for the first four months and only by 5% for a full five months. Ninety-eight per cent of mothers breast-fed their infants more than six times a day.[104]

In addition to the delayed onset of breast-feeding, most infants in Cambodia were introduced to supplementary fluids and foods too early. Among children aged 0 to 3 months – an age group where breast milk is 100% sufficient for nutritional needs and other liquids/foods pose a threat of infection – only 15.6% were exclusively breast-fed. The majority of children in this age group received plain water or sugar water as a supplement to breast-feeding and about a third also received other fluids or foods.

Conversely, the introduction of food supplementation to children aged 6 months and over – for whom breast milk is no longer sufficient and supplementation is nutritionally necessary – was not as rapid and widespread as it should have been to ensure an adequate nutritional status. Over one-third of Cambodian children aged 6-7 months did not receive any solid or semi-solid foods at all. Even at the age of one year, about 15% of children did not receive solid/ semi-solid food supplementation.

Immunisation

Childhood immunisation rates were calculated based on immunisations received by children aged 12-23 months at the time of the survey. Immunisations were recorded on a vaccination card, and immunisations reported by the mother in the absence of a card were taken into consideration. Only 48% surveyed by the CDHS had immunisation cards.[105] Overall, less than 40% of children born during the 12 to 23 months prior to the survey had received all the vaccines. The dropout rate between the first and third doses was 25% for DPT and 31% for polio.

4.4 Health and Nutritional Status of Adults and Children

Morbidity and Prevalence of Other Diseases

A number of factors together determine the health status of the population of Cambodia. Morbidity is one of them. The pattern of morbidity seems to have remained virtually unchanged for years, and the general populace seems to be greatly affected by the same diseases, including diarrhoea, acute respiratory infections, dengue, hemorrhagic fever, malaria, malnutrition and other vaccine-preventable diseases. There are also problems associated with past disruption and civil strife, including high amputation rates and psychological disorders.

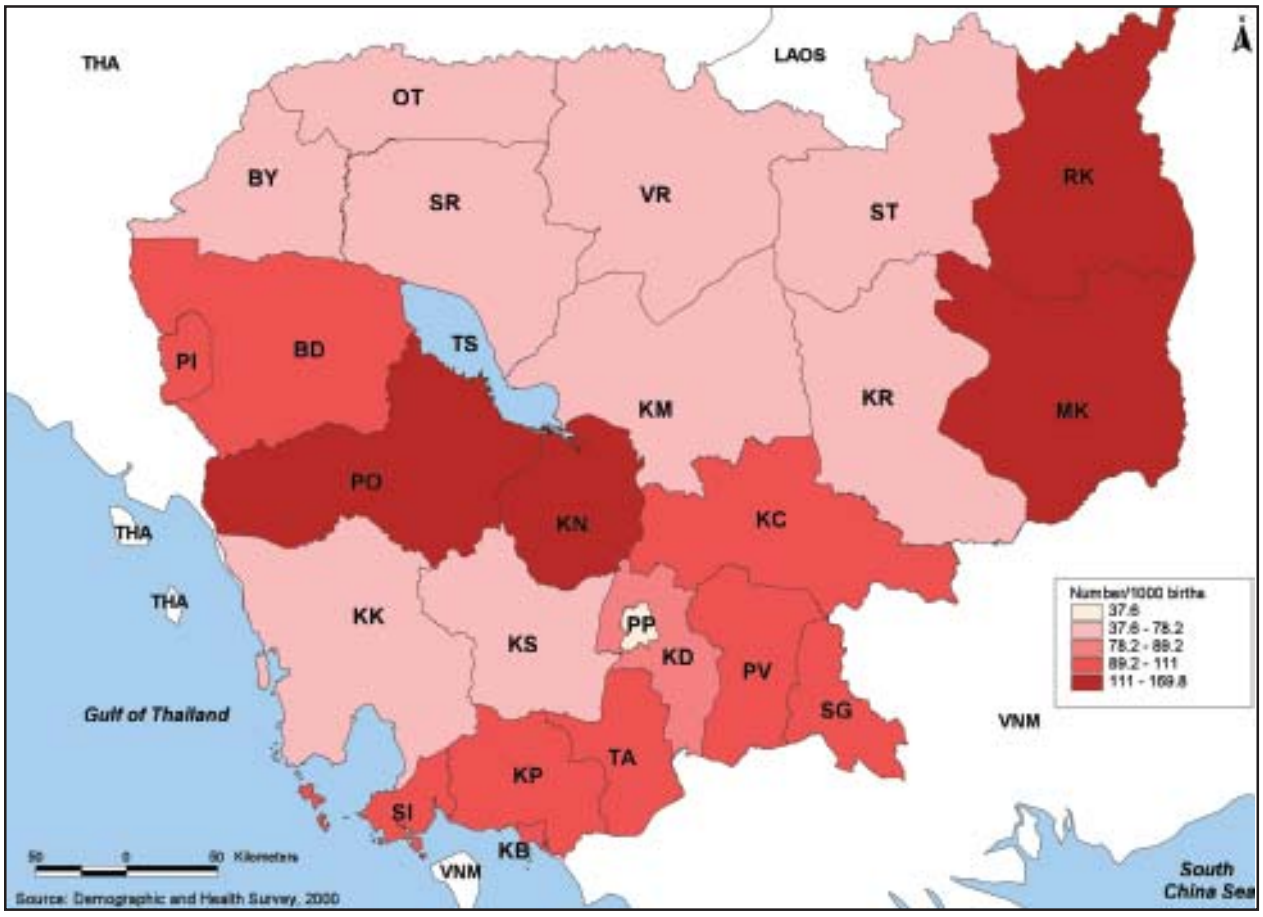
The CDHS 2000 recorded that the prevalence of diarrhoea for two weeks preceding the survey was 18%, out of which boys comprised 20% and girls 17%.

[103] National Council for Nutrition "Cambodia Nutrition Investment Plan" 2003-2007

[104] ibid

[105] ibid

Map 4.3 - INFANT MORTALITY RATE



The use of Oral Rehydration Solution (ORS) was as low as 17%, whereas 40% used rice water and 56% of mothers gave western medicines for diarrhoea.

Life Expectancy

Cambodia had a population of 11.4 million, according to the 1998 Census. The estimated population in January 2005 was 13.8 million, after due adjustments, based on CIPS data of 2004. About 42.8% of the population was under 15 years. As per the CIPS of 2004, the proportion of the child population in 1998 was re-estimated as 38.6%. In 2004, the proportion of children aged 0-14 was 38.8%, showing a small increase of 0.2% in the child population over the 6-year period.[106] As per the World Health Organization in their 'World Fact Book - January 2005', for Cambodia, the average life expectancy at birth was estimated at 58.9 years for both sexes. For males, life expectancy at birth was 55.9 years, while for females it was 61.9 years.

Infant, Child and Maternal Mortality Rates

The infant mortality rate (IMR) refers to the number of deaths per 1,000 live births in the age group of one year and under. Child mortality refers to deaths per 1,000 live births of children under the age of five. The maternal

[106] As per the Inter-Censal Survey, the 1998 population had been underestimated. The estimated population in 1998 was revised as 12.169 million instead of 11.747 million.

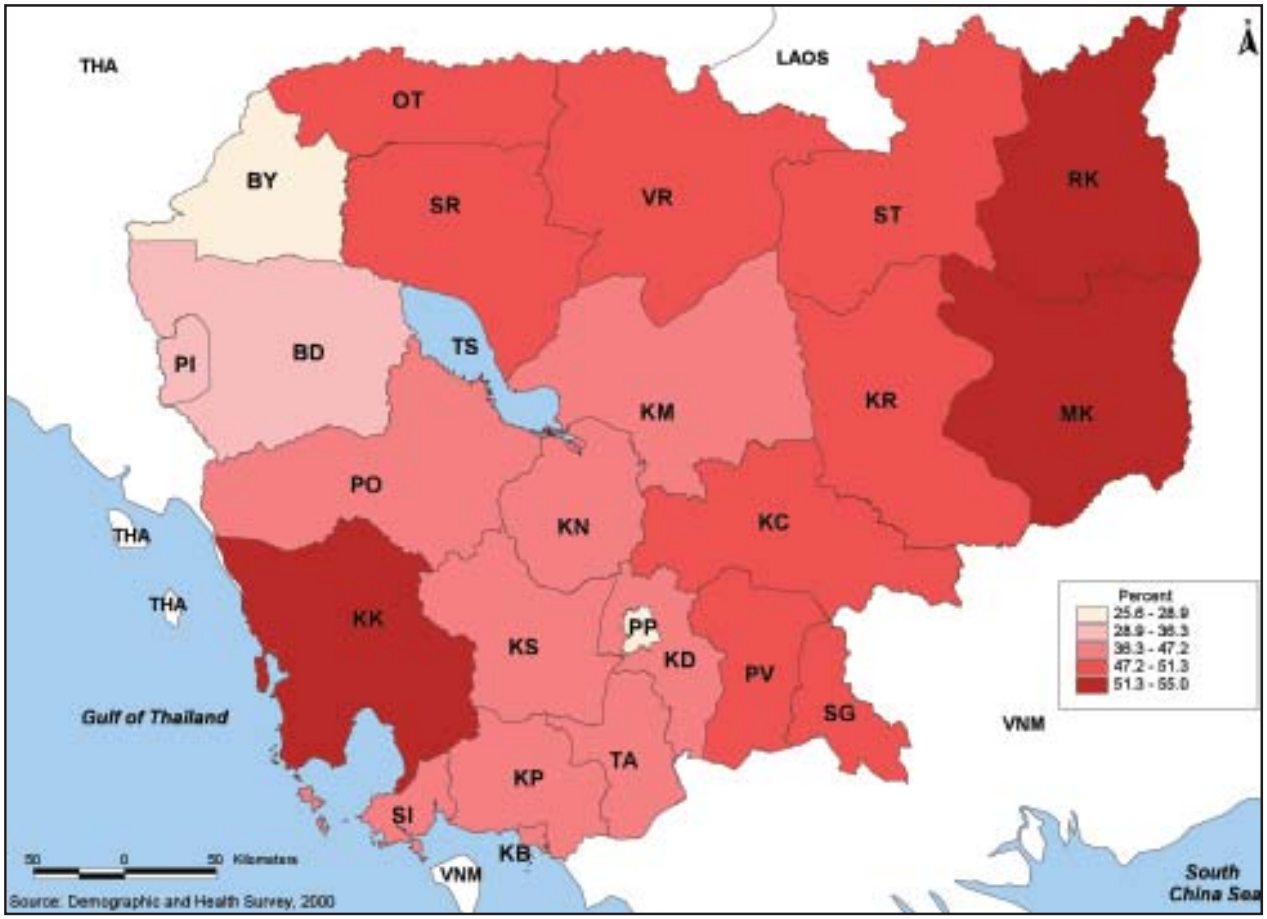
mortality rate (MMR) refers to the number of maternal deaths per 100,000 cases of childbirth.

The infant and child mortality rates seem to have fallen significantly in the recent past in Cambodia. The infant mortality rates have fallen, from 125 per 1,000 live births in 1990, to 123 per 1,000 live births in 1993, to 115 per 1,000 live births in 1997.[107]

According to the CDHS in the year 2000, the infant mortality rate was 95 deaths per 1,000 live births. Mortality during the first month, or neonatal mortality, was high (36 per 1,000), but post-neonatal mortality (between the first month and the first birthday) was much higher than expected (54 per 1,000) and it accounted for 60% of the total infant mortality.

The Infant Mortality Rate (IMR) was the lowest in Phnom Penh at 37.6, probably due to the influence of urbanisation; Kampong Thom came next with 64.5. Other provinces with low infant mortality rates were Kampong Speu, Koh Kong, Stung Treng, Preah Vihear and Kratie, with 68.3, 70.7, 71.3, 71.3 and 71.3, respectively. The infant mortality rate was highest in Ratanak Kiri and Mondul Kiri, with each province

Map 4.4 - PERCENTAGE OF MODERATELY STUNTED CHILDREN UNDER FIVE



[107] Ministry of Health & Demographic and Health Survey 'National Health Statistics' Ministry of Planning and Ministry of Health, 2000

Table 4.5 - Nutritional Status of Children					
No		Province/Municipality	% of Children Moderately Stunted	% of Children Moderately Wasted	% of Children Moderately Underweight
1	p	Banteay Meanchey	28.90	19.50	39.50
2	p	Battambang	36.30	21.10	36.40
3	p	Kampong Cham	48.20	15.60	47.80
4	p	Kampong Chhnang	45.90	9.50	46.10
5	p	Kampong Speu	44.50	16.90	44.00
6	p	Kampong Thom	47.20	24.50	49.40
7	p	Kampot	43.40	9.60	39.80
8	p	Kandal	46.20	11.80	48.20
9	p	Koh Kong	55.00	14.70	42.70
10	p	Kratie	51.00	10.90	47.00
11	m	Kep	43.40	9.60	39.80
12	m	Pailin	36.30	21.10	36.40
13	m	Sihanoukville	43.40	9.60	39.80
14	p	Mondul Kiri	55.00	15.20	54.00
15	p	Oddar Meanchey	50.70	10.60	49.90
16	m	Phnom Penh	25.60	18.30	35.00
17	p	Pursat	46.30	13.40	46.30
18	p	Preah Vihear	51.00	10.90	47.00
19	p	Prey Veng	51.20	15.10	56.80
20	p	Ratanak Kiri	55.00	15.20	54.00
21	p	Siemreap	50.70	10.60	49.90
22	p	Stung Treng	51.00	10.90	47.00
23	p	Svay Rieng	51.30	13.00	45.90
24	p	Takeo	42.10	17.20	39.90

Source: Cambodia Demographic and Health Survey, 2000.

having a rate of 169.8. The other provinces fall in the middle range of IMRs (Table 4.4) (Map 4.3).

The under-5 mortality rate decreased slightly from 200 per 1,000 live births in 1990, to 181 per 1,000 live births in 1997. From 1997 to 1998, the under-5 mortality rate declined sharply to 115 per 1,000 live births, and then slowly increased to 125 per 1,000 live births in 2000. At the level of 115 deaths per 1,000, more than one in nine Cambodian children would be expected to die before their fifth birthday.

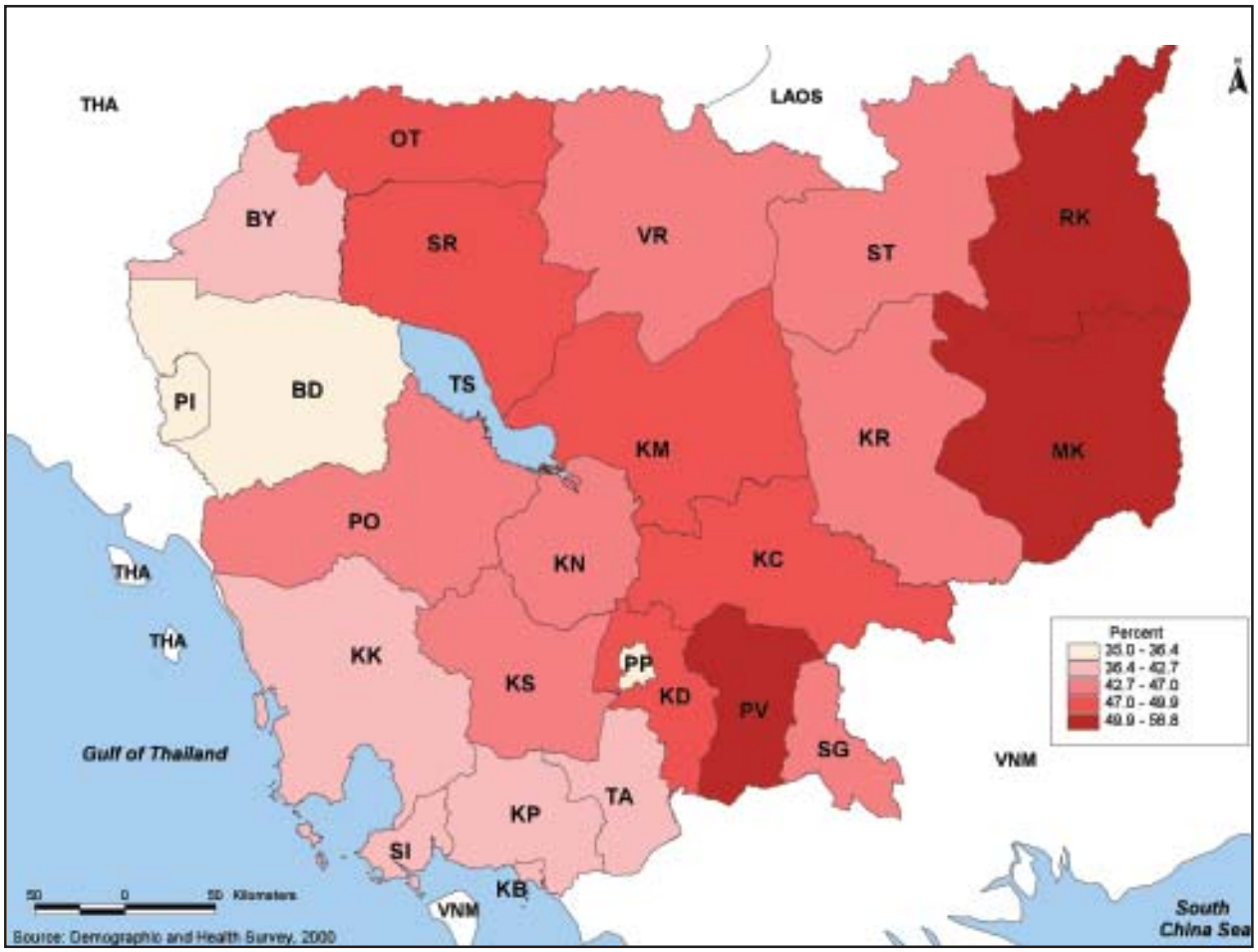
As per the CDHS 2000, the mortality rate between the first and the fifth birthday was 28 deaths per 1,000 children surviving at their first birthday. The CIPS of 2004 also concluded that child morality was declining fast, though it observed that further work was required before generalising the finding. The decline in the under-5 mortality may be attributed to the promotion and education on health services and related activities of the government at all levels. The MMR was 437 per 100,000 live births, due mainly to abortion complications, eclampsia and haemorrhage.

Child Malnutrition - Growth Faltering

Malnutrition is the direct result of an unbalanced diet, repeated infectious diseases, or a combination of both. It can result in increased risk of illnesses and death. There are three measures of growth faltering – stunting, underweight and wasting, which are normally considered as indicators of malnutrition in children.

Lack of height-for-age (stunting) reflects inadequate linear growth due to prenatal and postnatal deficiency, which reflects the long-term, cumulative effects of inadequate nutrition and health. Stunting of a child's growth may result from a number of factors that include failure to receive adequate nutrition over a long period, sustained improper feeding practices and repeated episodes of illness. Height-for-age therefore represents a measure of the outcome of undernutrition in a population over a long period and does not vary appreciably with the season of data collection.

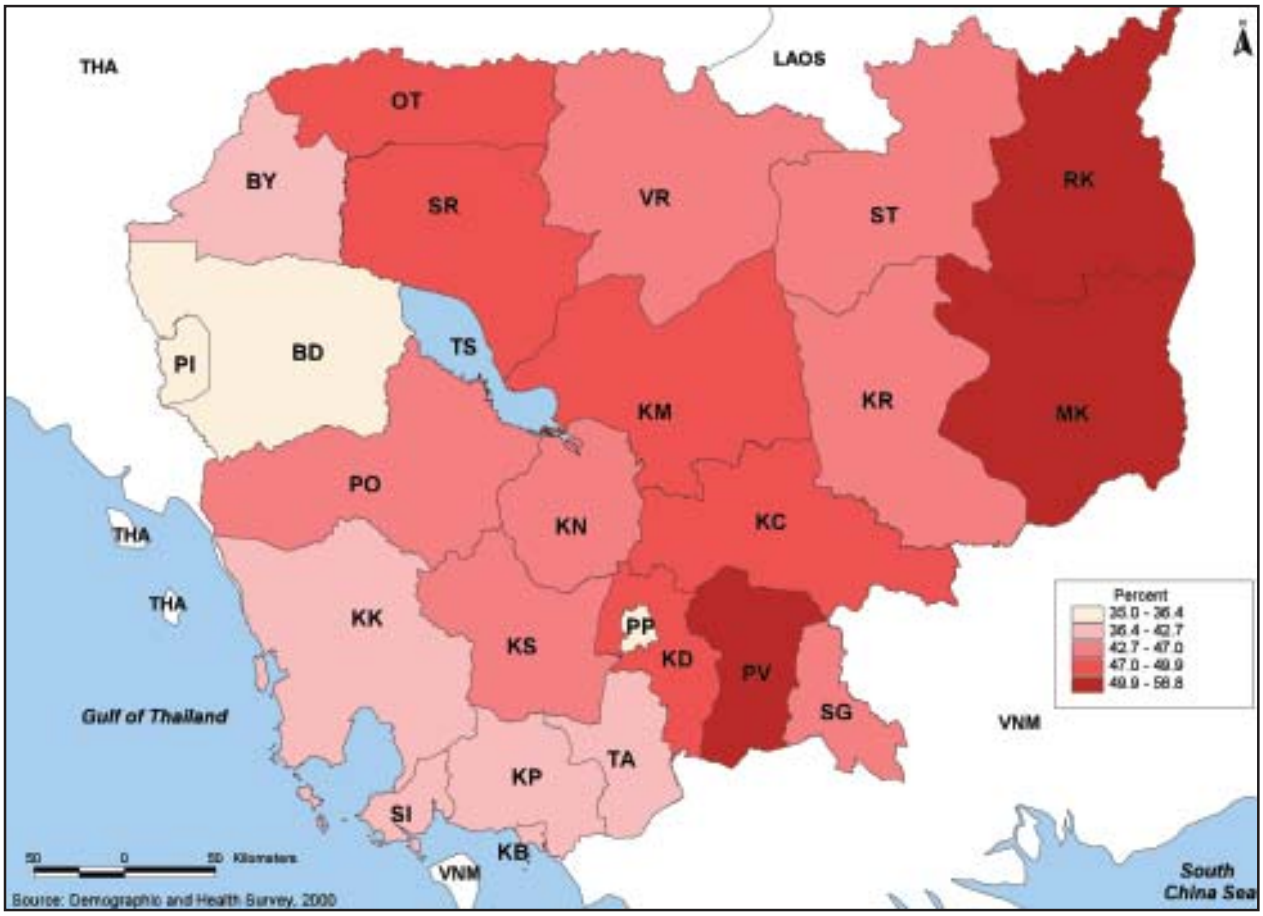
Map 4.5 - PERCENTAGE OF MODERATELY UNDERWEIGHT CHILDREN UNDER FIVE



The weight-for-height measures body mass in relation to body length. It describes a recent and severe process that has produced a substantial weight loss, usually as a consequence of acute shortages of food or severe disease. Low weight-for-height (wasting) represents the failure to receive adequate nutrition during the period immediately before the survey and usually shows marked seasonal patterns associated with changes in food availability or disease prevalence. It may be the result of recent episodes of illness, particularly diarrhoea, improper feeding practices, or acute food shortage. Weight-for-age is a composite index of height-for-age and weight-for-height. It represents body mass relative to age. Being underweight for one's age therefore could either mean that a child is stunted or wasted, or both, stunted and wasted. In the absence of wasting, both weight-for-age and height-for-age reflect the long-term nutrition and health experience of the individual or population.

Chronic malnutrition among Cambodian children was high, with 45% of children moderately stunted and more than one in five children (21%) severely stunted. The level of stunting increased rapidly with age, from 15% among children less than six months of age to about 50% among children aged three years and older. The prevalence rate of malnutrition (for both underweight and stunting) for children between 0-59

Map 4.6 - SEX RATIO



[108] National Council for Nutrition "Cambodia Nutrition Investment Plan" 2003-2007

months was recorded to be 45% by CDHS in 2000.[108] There was little difference in the level of stunting by sex. First order births were least likely to be stunted, compared with children of birth order six or above. The length of the birth interval was inversely related to stunting. However, children with a birth interval of less than 24 months had the highest level of stunting (55%). Rural children were more likely to be stunted than urban

Table 4.6 - Sex Ratio

No		Province/Municipality	Sex Ratio (females per 100 males)	Sex Ratio (males per 100 males)	Juvenile Sex Ratio
1	p	Banteay Meanchey	103.90	96.24	104.90
2	p	Battambang	104.10	96.06	104.90
3	p	Kampong Cham	107.39	93.12	105.10
4	p	Kampong Chhnang	111.29	89.86	103.20
5	p	Kampong Speu	108.39	92.26	103.60
6	p	Kampong Thom	108.57	92.11	103.90
7	p	Kampot	108.79	91.92	104.80
8	p	Kandal	108.36	92.29	105.00
9	p	Koh Kong	95.13	105.11	102.60
10	p	Kratie	102.05	97.99	104.80
11	m	Kep	104.51	95.68	107.40
12	m	Pailin	84.85	117.86	101.60
13	m	Sihanoukville	102.35	97.70	104.70
14	p	Mondul Kiri	97.84	102.20	103.70
15	p	Oddar Meanchey	98.07	101.97	104.20
16	m	Phnom Penh	107.47	93.05	104.40
17	p	Pursat	108.48	92.18	102.90
18	p	Preah Vihear	101.00	99.01	103.90
19	p	Prey Veng	112.53	88.87	104.10
20	p	Ratanak Kiri	103.13	96.97	103.70
21	p	Siemreap	106.77	93.66	104.30
22	p	Stung Treng	102.06	97.98	105.00
23	p	Svay Rieng	112.46	88.92	104.10
24	p	Takeo	109.64	91.20	105.20

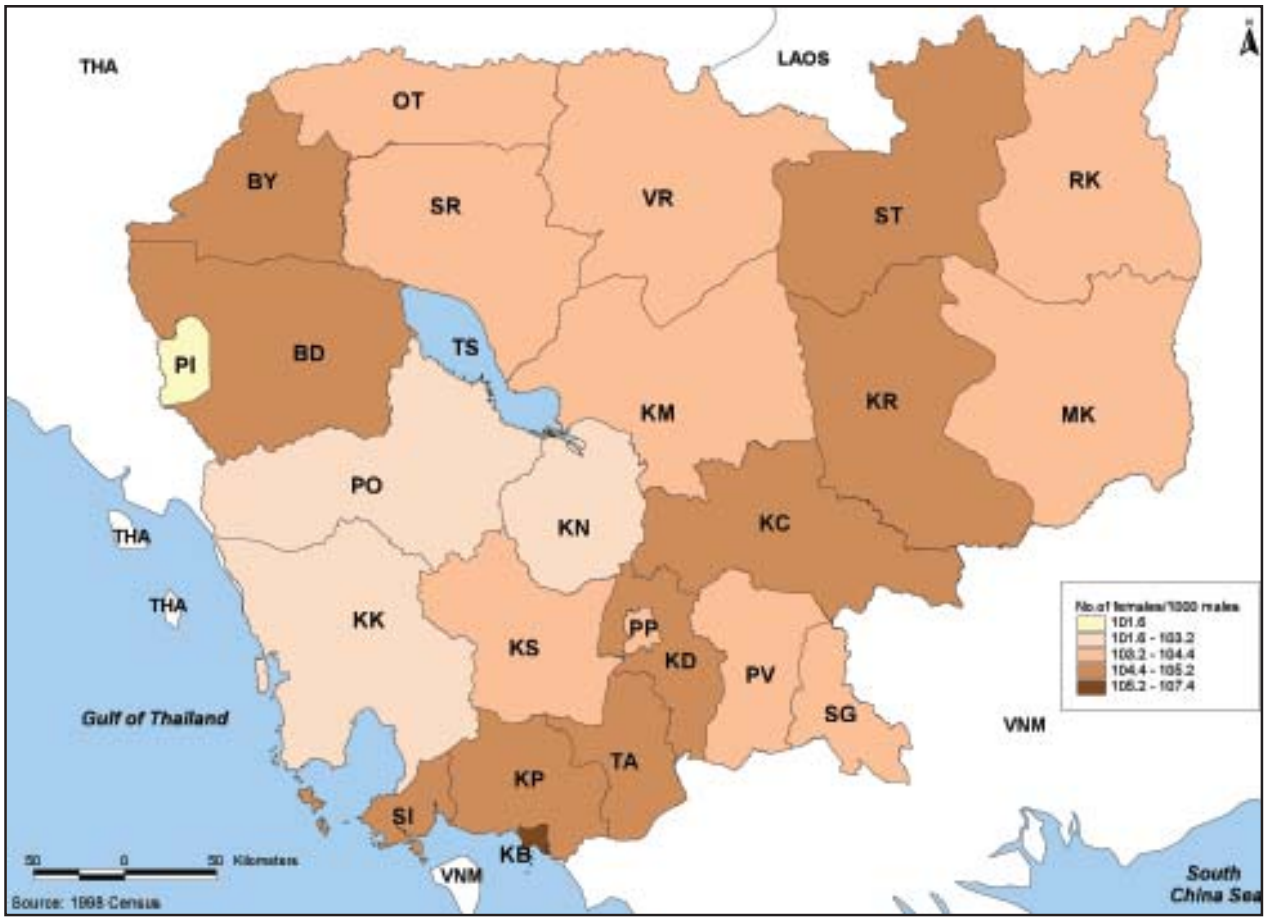
Source: General Population Census of Cambodia 1998, Census Tables at National Level, Cambodia, National Institute of Statistics, Ministry of Planning, Phnom Penh, Cambodia.

children, and children residing in Phnom Penh were much less likely to be stunted. The mother's education had a positive impact on children's nutritional status. Thirty-five per cent of children of highly educated mothers were stunted, as compared to 51% of children whose mothers were uneducated.

Fifteen percent of children under five years of age were wasted, and 4% were severely wasted. The proportion of wasted children was highest in the 12-15 month age group, which could indicate inadequate food supplementation during the weaning period and exposure to diseases. Wasting increased with birth order, as more children were likely to compete for a limited quantity of food, especially in poor households. Rural children were more likely to be wasted than urban children. The percentage of children under five who were stunted was lowest in the province of Phnom Penh with 25.6%. Among the other provinces, the better off were Banteay Meanchey, Pailin, Battambang and Takeo, with 28.9%, 36.3%, 36.3% and 42.1%, respectively. It was highest in the provinces of Ratanak Kiri and Mondul Kiri, each with 55% (Table 4.5) (Maps 4.4 and 4.5)

The overall wasting rate, as recorded by the CDHS, was 15% in 2000, which was an increase from 13% in 1996. The extent of severe malnutrition was

Map 4.7 - JUVENILE SEX RATIO (0-14) YEARS



[109] National Council for Nutrition "Cambodia Nutrition Investment Plan" 2003-2007

Table 4.7 - Nutritional Status of Women				
No		Province/Municipality	BMI (kg/m2) % < 18.5	% of Women with Anaemia
1	p	Banteay Meanchey	20.10	65.40
2	p	Battambang	10.20	47.50
3	p	Kampong Cham	21.10	58.20
4	p	Kampong Chhnang	24.90	51.40
5	p	Kampong Speu	23.30	59.60
6	p	Kampong Thom	19.70	66.80
7	p	Kampot	16.30	51.40
8	p	Kandal	25.00	54.20
9	p	Koh Kong	14.80	44.40
10	p	Kratie	21.70	60.10
11	m	Kep	16.30	51.40
12	m	Pailin	10.20	47.50
13	m	Sihanoukville	16.30	51.40
14	p	Mondul Kiri	22.60	63.00
15	p	Oddar Meanchey	21.30	69.20
16	m	Phnom Penh	20.20	52.60
17	p	Pursat	15.90	63.30
18	p	Preah Vihear	21.70	60.10
19	p	Prey Veng	22.40	54.60
20	p	Ratanak Kiri	22.60	63.00
21	p	Siemreap	21.30	69.20
22	p	Stung Treng	21.70	60.10
23	p	Svay Rieng	20.20	60.20
24	p	Takeo	25.80	64.60

Source: Cambodia Demographic and Health Survey, 2000. Note: BMI - Body Mass Index.

alarming, as severe underweight and severe stunting, of 13% and 21%, respectively, were recorded among children. In fact, wasting had doubled to 3.8% in 2000, from 2% in 1996.[109] This is an indication of the fact that socio-economic development had not benefited everyone equally.

[110]The sex ratio in this report is given as number of males per female.

Juvenile Sex Ratio [110]

The sex ratio of the age group 0-14 was considered, as this group is free from migration bias and the members will also be in the reproductive age in another 10 years. The sex ratio in this age group shows whether girl child mortality is higher than boy child mortality, due to possible discrimination in feeding, nutrition and provision of timely health care. Even in societies that have more females than males, the juvenile sex ratio tends to be adverse with fewer girls than boys, showing the preference for a boy and neglect of the girl. Once the girl survives the maternal age, women live longer than men, and the sex ratio changes in favour of women. Even if the overall sex ratio is not adverse, the adverse juvenile sex ratio of there being more boys than girls in this age group points to discrimination towards girls.

For the country as a whole, as per the CIPS 2004, the sex ratio was in favour of women at 93.5 males for 100 females. The reasons for the sex ratio being in favour of women, and the deficit of men at the overall level, are the death of men in periods of internal and external conflict and out-migration of men away from home to other countries for better-paid work.

The juvenile sex ratio (0-14) was adverse, both in 1998, and in the CIPS of 2004. There were more males than females in this age group. The situation in fact deteriorated in 2004, with six males more per 100 females (106), compared to four males more per 100 females in 1998 (104). This indicates the existence of a certain degree of discrimination that leads to higher mortality of the girl child compared to the boy child. The juvenile sex ratio was better in the province of Pailin town at 101.6, followed by Ratanak Kiri, Kampong Speu, Oddar Meanchey and Preah Vihear. The worst sex ratio was in the province of Kep, with 107.4. Even though Phnom Penh is an urban area, the sex ratio for children between 0-14 years was only 104.4 (Table 4.6) (Maps 4.6 and 4.7).

Nutritional Status of Women: Low Body Mass Index (BMI)

Women's nutritional status is important both as an indicator of overall health and as a predictor of the outcome of pregnancy for both the mother and child. Maternal height is a measure of past nutritional status and reflects in part the cumulative effect of social and economic outcomes on access to nutritional foods during childhood and adolescence. A short stature is also correlated with low birth weight in infants, high risk of stillbirths and high rates of miscarriage. A woman is considered to be at nutritional risk if her height is in the range of 140 to 150 centimetres. The Body Mass Index (BMI) takes into consideration both the height and weight and provides a better measure of the physical condition than weight alone. BMI is defined as weight in kilograms divided by the square of the height in meters (kg/m2) (Table 4.7).

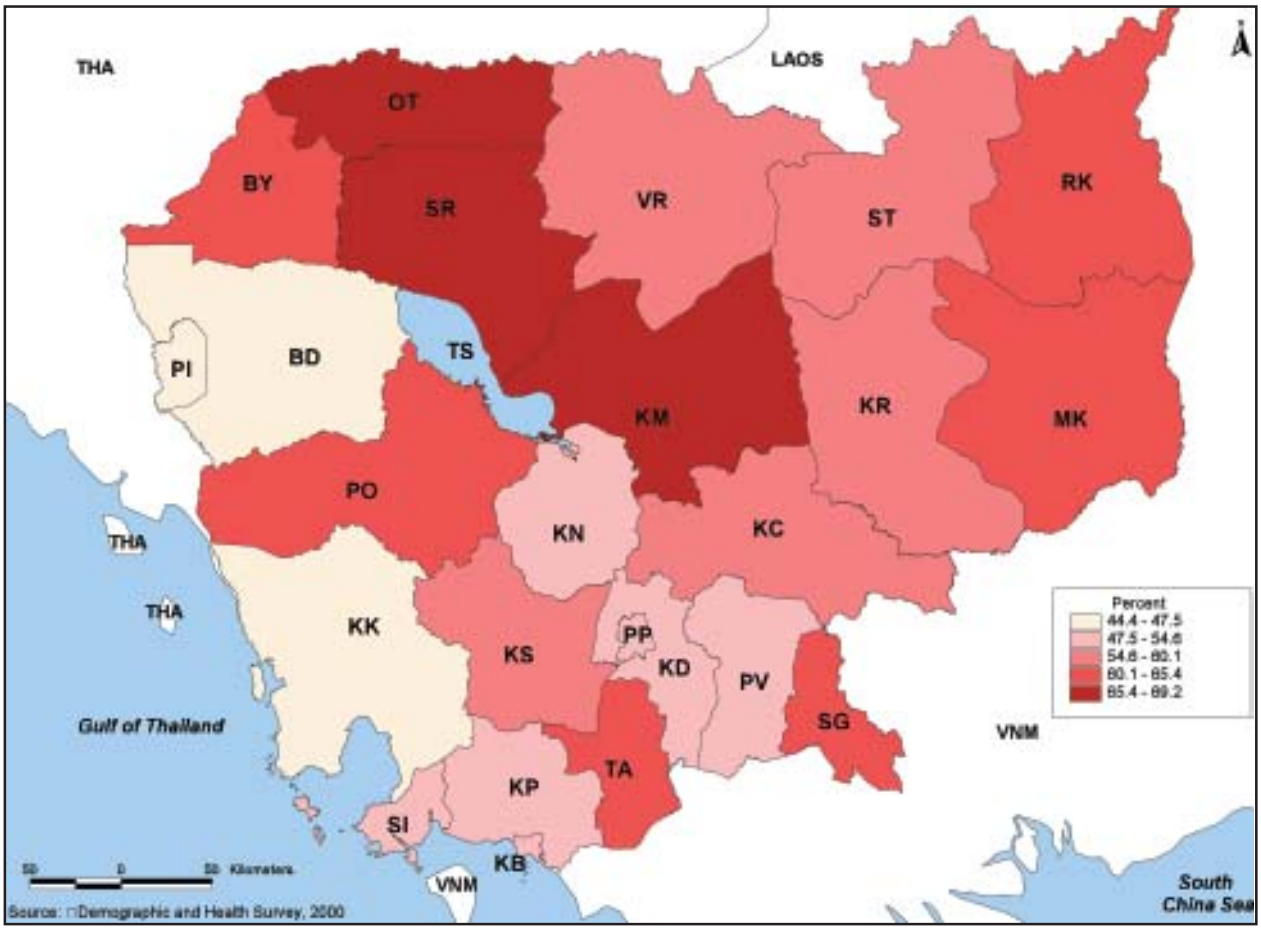
The mean height of Cambodian women is 153 cm. About 6% of women are shorter than 145 cm. Rural women are shorter than their urban counterparts. The percentage of women whose height is below 145 cm was highest in Mondul Kiri and Ratanak Kiri and lowest in Phnom Penh.

One in five women fell below the cut off value of BMI of 18.5, indicating that chronic energy deficiency was relatively high in Cambodia. About 1 in 15 women had a BMI of more than 25 and thus could be considered overweight. In general, very young women (15-19) and rural women are more likely than other women to suffer from chronic energy deficiency.

Micronutrient Status

The causes and consequences of early childhood deficiencies have implications in later life and may be present as risk factors for future generations. Starting with the foetus, iodine deficiency disorder (IDD) may cause brain damage or stillbirth. Severe iron-deficiency anaemia during pregnancy may even place a woman's life at risk during childbirth. Iron-deficiency anaemia and vitamin 'A' deficiency (VAD) may also have significant implications for the infant born with low stores of the vitamin. VAD may increase morbidity and mortality risk and affect vision, while anaemia and IDD may lead to cognitive deficits.

Map 4.8 - PERCENTAGE OF WOMEN WITH ANEAMIA



Iron-deficiency Anaemia

Iron-deficiency anaemia occurs when iron stores are exhausted and the supply of iron to the tissues is compromised. The prevalence of anaemia, defined by low haemoglobin is commonly used to assess the severity of iron deficiency in a population. As per the CDHS survey in 2000, the prevalence rate of iron-deficiency anaemia among children was 63%. Of these, 70% were children below the age of 2 years and they were severely affected. Among women it was 58%, and among pregnant women it was 65%. It is considered as one of the main causes behind increased MMR rates (437 per 100,000 live births). Sadly, only 16% of women took iron supplementation during pregnancy.[111] The haemoglobin cut off used to define anaemia in pregnant women and pre-school children (6 months to 5 years) is 11 grams per decilitre (g/dl) of haemoglobin.

Iron-deficiency anaemia is a major threat to safe motherhood: it contributes to low birth weight, low resistance to infection, poor cognitive development and poor work capacity. In children, iron-deficiency anaemia is associated with impaired cognitive performance, motor development, coordination, language development and scholastic achievement. Anaemia increases morbidity from infectious diseases because it adversely affects the immune response.

[111] National Council for Nutrition "Cambodia Nutrition Investment Plan" 2003-2007

Table 4.8 - Major Nutritional Indicators, CDHS 2000, Other Sources and Targets for 2007

No	Indicators	Other Source	2000 CDHS	Target 2007
I	**Breast-feeding:**			
1	Mothers who start breast-feeding newborn child with in 1hour of birth		11%	35%
2	Infants exclusively breast-fed up to 5 months of age*		5%	25%
3	Mean duration of breast-feeding		24m	24m
II	**Nutritional Status of Children under 5 Years:**			
1	Underweight		45%	31%
2	Stunting		44%	30%
3	Wasting		15%	10%
III	**Nutritional Status of Women 15-49 Years Old:**			
1	Women with BMI<18.5 Kg/Sq. metre		21%	15%
2	Women stunted (<145cm tall)		6%	5%
3	Low birth weight babies		15%	10%
IV	**Iron Deficiency Anaemia (IDA)**			
1	Children 6-59 months age		63%	42%
2	Women 15-49 years old:		58%	40%
3	Pregnant women		66%	43%
4	Women taking iron supplements for at least 2 months during pregnancy		4%	40%
v	**Vitamin A Deficiency (VAD)**			
1	Night blindness among pregnant women		8%	4%
2	Women rec.d a post-partum Vitamin A supplement		11%	80%
3	Children received Vitamin A capsules 6 months prior		29%	80%
VI	**IDD:**			
1	Households using iodised salt		14%	80%
2	Goitre	12%*		4%

Source: Cambodia Nutrition Investment Plan(CNIP), 2003-2007, National Council for Nutrition * MOH policy is exclusive breastfeeding up to 6 months of age. CDHS indicator reported above was collected for babies exclusively breastfed up to the age of 5 months.

Table 4.9 - Key Health Indicators for Cambodia

No	Indicator	Cambodia
1	Infant Mortality Rate per 1000 live births*	95
2	Maternal Mortality Rate per 100000*	437
3	Contraceptive Prevalence Rate **	24%
4	One-year-old Immunized-Measles (2003)**	65%
5	In-Patient Bed Occupancy Rate (2004)***	60.7%
6	Total Fertility Rate****	3.23
7	Adult Literacy Rate (2004)****	73.6%
8	Adult HIV/AIDS Prevalence +	1.9%
9	Crude Birth Rate per 1000 ++	34.1%
10	Average Life Expectancy at Birth+++	58.9

Source: * CDHS 2000; ** Human Development Report 2005; *** National Health Statistics Report;**** CIPS 2004; + HIV Sentinel Survey NCHADS 2003; ++ General Population Census of Cambodia 1998; +++ World Health Organization 2005.

The percentage of women with anaemia was the lowest in the province of Koh Kong, each with 44.4%. Pailin and Battambang were the other provinces with 47.5% of women showing some anaemia. The most urbanised, Phnom Penh, had 52.6% of women with anaemia. It was highest in the provinces of Siemreap and Oddar Meanchey, each with 69.2% (Table 4.7) (Map 4.8).

Vitamin A Deficiency

Vitamin A is a micronutrient essential for the normal functioning of the visual system, growth and development, maintenance of epithelial cellular integrity, immune function and reproduction. Vitamin A Deficiency (VAD) occurs when body stores are depleted to the extent that physiological functions are impaired. Improving the vitamin A status of young children reduces mortality rates. VAD is linked more to the nature of foods available and feeding practices than to other conditions affecting the whole population of geographic areas.

Three-quarters of the Cambodian provinces recorded incidence of VAD in the micro-surveys conducted between 1990 and 1996. About 12% prevalence of night-blindness was recorded in Takeo province. The lack of water, preventing vegetable cultivation during the dry season, has been seen as the main reason behind the low consumption of vitamin A-rich foods among children. Only 29% of children below 5 years, nationwide, had received a vitamin A supplement as per the CDHS survey in 2000. The prevalence of diseases like measles, acute respiratory infections and diarrhoea, known to predispose children to VAD, was at the rate of over 40%.[112]

Consumption of foods rich in vitamin A and supplements increased with age. A mother's education was associated with an increased intake of supplements, however, it was not related to consumption of foods rich in vitamin A among children, as per the CDHS 2000 (Table 4.8).

Iodine Deficiency

Iodine deficiency disorder (IDD) is induced by dietary iodine deficiency and it constitutes a major global nutritional concern. Iodine is required for the synthesis of the thyroid hormones, which are involved in regulating metabolic activities of cells throughout the life cycle. It plays a key role in cell replication. This is particularly relevant to the brain since neural cells multiply mainly in the uterus and during the first two years of life.

Iodine deficiency in the foetus leads to increased rates of abortion, stillbirths, congenital anomalies, cretinism, psychomotor defects and neonatal mortality. In children and adults, the effects manifest themselves as goitre, hypothyroidism, impaired mental functions, abnormal mental and physical development and diminished school performance. Iodine deficiency can be avoided by using salt that has been fortified with iodine.

[112] National Council for Nutrition "Cambodia Nutrition Investment Plan" 2003-2007

The projected national average rate of goitre was 12% in the age group of 8-12 years, but in some areas the incidence was as high as 45%, as recorded in the first national goitre survey conducted by the Ministry of Health in 1997. An estimated 1.3 million individuals were at the risk of IDD, thus listing Cambodia among the nations most affected by this disorder. At the national level, only 12% of households were using iodised salt, as a high proportion of salt sold showed low iodine content, according to CDHS data.[113] Overall health indicators for Cambodia are shown in Table 4.9.

4.5 Determinants of Underweight in Children:

Household-level analysis

From the household-level data of the Asia-Pacific region, data relating to Cambodia was separated out and used for the purpose of analysis.[114] Our aim was to understand how the physical health of a child was affected by the prevailing socio-economic characteristics at the household level. The dependent variable was the z-scores of weight-for-age for children. The data were restricted to children in the age group of 0-5 years.

The z-scores for the Asia- Pacific region varied from –6 to +6. In the case of Cambodia, the underweight z- scores varied between + 4.03 and -5.97. The z-scores were arranged in descending order. For the purpose of the study, we took the cases that scored greater than 2 and scaled them to zero. The reason for doing this was to remove the bias of overweight children from the regressions. All of the children with a z score of 2 and above were made zero. In other words, they were all put in the same category. The remaining scores were then again scaled, between 0 and 8, using the indexing method. The following formula was used to scale or index the z-scores.[115]

$$Y = [(\text{Maximum value} - \text{Observed Value}) * 8] / (\text{Maximum Value} - \text{Minimum Value})$$

For the most underweight child, the z-score would be the lowest, i.e., there would be the highest negative deviation away from the reference point. The scaled (indexed) value would then be 8, as per the above formula. For the well-fed child, the weight would deviate in a positive direction from the reference score. In that case, the scaled (indexed) score would be 0. Therefore, the index of weight-for-age in children ranged from 0 to 8. The child that was severely underweight would get a value of 8, and a child who was not underweight would have an index with a value 0. A z-score greater than +2 meant that a child's weight for age was 2 standard deviations above the reference level. This meant that the child was very well fed, perhaps even obese. As we wanted to concentrate only on underweight children, we combined all those with z-scores greater than two in one category. They were assigned the value of 0. The remaining scores were then scaled using the above methodology.

Most of the data on independent variables was qualitative in nature and took the binary value of either 1 or 0. Hence, the application of the Ordinary Least Squares (OLS) method had lower predictive value and only very broadly indicated the positive or negative relationship with other important factors. It was not possible to attach greater meaning to the coefficients.

To understand the household factors that influence underweight in children, we selected several characteristics and examined their relationship to underweight represented by the category into which the child was classified. We used six models with different variables. (Appendix 4.1)

The results of the analysis show that the higher the number of children born to a mother, the more likely the child would be underweight. Children who were still being breast-fed were not underweight, and the first born was better off than the other children.

[113] National Council for Nutrition "Cambodia Nutrition Investment Plan" 2003-2007

[114] We are grateful to United Nations' Hunger Task Force for providing us with the household level data for the entire Asia Pacific region in the format of weight for age (underweight) Z scores in connection with one of the papers contributed to the study.

[115] The method was the same one used for Human Development Index (HDI) calculation, except that it was multiplied by 8 to make the variations large. Larger variation helps to interpret the regression result better.

In the analysis, the immunisations received had no significant influence on the weight-for-age of the baby. However, the morbidity index had a negative influence, showing that children with a high incidence of disease were underweight-for-age. Better sanitation was also related to healthier children. The mother's education beyond primary level was related to fewer underweight children. However, the education of the partner had no relevance to the child's weight-for-age. Poverty proxies, such as having electricity or a television in the house were related to less underweight children. It was obvious that poverty groups had more underweight children in the house, than others who were better off. Another interesting result was that when the mother was employed as a labourer, or employed in services, there was not much difference in the child's weight-for-age. However, if the mother was employed in agriculture, her child was more likely to be underweight. Thus, the under-nutrition of rural children was obvious. In addition, education beyond secondary level made a difference to the child's weight-for-age.

Concluding Remarks

This analysis attempts to capture the various determinants of underweight children at the micro-level in Cambodia. The best-fitting model explained 6% of the variations in the dependent variable. This is a good fit considering that most of the variables were qualitative in nature. The results of the model have several policy implications. Some recommendations based on the above models would be:

*Encourage mothers to breast-feed children and introduce mother-friendly policies at workplaces;

*Improve sanitary conditions by providing toilets;

*Provide quality primary education for girls; and

*Policies must be specially targeted towards mothers employed in the agricultural sector.

CHAPTER - 5

Food Security Index of Cambodia

CHAPTER 5

Section A

Food Security Index at Province Level

The composite index of food security is based on various indicators explained in the preceding chapters. The three aspects of food security, namely food availability, food access and food absorption, have been analysed in detail in Chapters Two, Three and Four at the provincial level. Some of these aspects were selected and consolidated into a composite Food Security Index for each province in Cambodia. The index was then used to produce a Food Security Map of Cambodia.

5.1 Mapping Food Security

The Food Security Index was calculated by combining the following 10 indicators:

1. Deficit in per capita production of paddy over per capita consumption in 1998;
2. Percentage of population below the poverty line;
3. Percentage of literates to the total population;
4. Percentage of unemployed to the labour force;
5. Infant mortality rate;
6. Percentage of women with anaemia;
7. Percentage of moderately stunted children;
8. Juvenile sex ratio (0-14);
9. Percentage of population with access to safe drinking water; and
10. Percentage of population with access to toilets.

There was one food availability indicator, three access indicators and six absorption indicators. All these indicators carry the same weight. However, there is an implicit weight for each dimension of food security: food availability, food access and food absorption. If more than one indicator relates to a specific dimension, then that dimension received more weight. With one indicator, food availability received an implicit weight of 10%, with three indicators, food access received an implicit weight of 30% and food absorption, with six indicators, received an implicit weight of 60%. Hence, the final Food Security Index gives more emphasis to nutrition and health status and livelihoods, underlining the fact that nutrition and health problems, as well as livelihood problems, are more important than mere food availability.

In the case of food availability, deficit in production, compared to per capita consumption, was the only indicator used to obtain the index, as other availability indicators were closely correlated to each other. The three indicators of food access represented livelihood vulnerability due to poverty, unemployment and literacy. To represent food absorption, six indicators were chosen. All the indicators of food absorption are long-term outcomes of inadequate food intake[116] and improper absorption. Infant mortality and moderate stunting in children represent child health, health care facilities and other key issues of nutrition status.

[116]Though infant mortality, weight-for-age and height-for-age appear to be short-term indicators, the causes are deep rooted and cannot be remedied in 1-5 years. Better nutrition for expectant and lactating mothers, and preschool children, clean drinking water, and health care, etc., consistently for decades, is a prerequisite to solve the problem of underweight in children. Hence, it is considered as a long-term outcome.

Three separate sub-indices of food availability, food access and food absorption were calculated using the respective indicators. Each of these sub-indices provided an indication of the position of a province vis-à-vis others, with respect to food availability, food access and food absorption. The final Food Security Index is given as a separate index that includes all selected indicators.

5.1.1 Methodology of Indexing

There are ten indicators and each indicator is represented by 'k' that varies from one to 10. The individual indicators are converted into an index using a formula similar to the Human Development Index (Human Development Report, UNDP 2002). The number of observations of the 'k' indicator vary from 'i' to 'n', where 'i' varies from 1 to 24; that is, 1-24 provinces. Thus, k11 represents the kth variable for the first indicator and the first province. For any given indicator the index has been calculated as follows.

V k i = Value of kth indicator for ith province

V k min = Minimum value of k

V k max = Maximum value of k

I k i = Index of k th Indicator for i th province

$$I_{ki} = (V_{ki} - V_{k\min}) \div (V_{k\max} - V_{k\min})$$

Where the value varies between 'i' to 'n' states (n = 24) for the kth indicator.

The values of 'I k ' vary between one and zero. This means that the maximum value in the series for the indicator 'k' receives an index of one. The minimum value receives an index of zero. Thus, all the 24 values of an indicator k vary, between one and zero. All the values of I k for a given province are averaged together to obtain the composite index. To calculate the availability sub-index, the single indicator is converted into an index, which is the sub-index for availability. We calculated the food access sub-index when we averaged the three food access indices. Similarly, we obtained the food absorption sub-index when we averaged the six food absorption indices.

Conceptually, the individual indices measures the distance between a given province and the worst possible province for that indicator, as a proportion of the distance between the best province and the worst province. When the highest value in the series represents the best situation and the lowest value represents the worst situation, the application of the above formula results in the best of the provinces receiving an index number of one and the worst of the provinces receiving an index value of zero. All the indices are calculated in such a way that they are unidirectional.

For example, this method applied to an indicator such as percentage of literates in the population where, the higher the value, the better the situation, gives an index value of one to the province where the percentage of literacy is the maximum. It gives a value of zero to the province where the percentage of literates is the lowest.

In some cases, such as percentage of people below the poverty line, the higher the value the worse off the situation, whereas the lower the value the better the situation. In such cases, a small variation has been introduced in the calculation of the index to maintain the unidirectional approach to the index. The numerator of the formula has been changed to.

$$I_{ki} = (V_{k\max} - V_{ki}) \div (V_{k\max} - V_{k\min})$$

Thus, the value of the index with the largest percentage of poverty becomes one, and the value of index with the lowest percentage of poverty becomes zero. Thus, all the index values have been calculated for all ten indicators k 1 to k 10 for all provinces from 1 to 24 (Table 5.1).

5.2 Composite Map of Food Availability

Seven indicators were identified to represent food availability. Since these indicators were highly correlated to each other, only one indicator was chosen for the final index. The indicators and their correlations were examined before choosing the final indicators. The data on irrigated area was not reliable, and it also correlated positively with production and negatively with forest area. The composite map of food availability is based on an index calculated using only one indicator, namely, per

Table 5.1 - All Food Security Indices with Ranks

N-0.		Province/ Municipality	Defi-cit/-Ava-ilab-ility Ind-ex	R-a-n-k	Pover-ty Rate Index	R-a-n-k	Tot-al Liter-acy Rate Ind-ex	R-a-n-k	Total Unem-ploy-ment Rate Index	R-a-n-k	Infant Mortality Rate Index	R-a-n-k	% of Women with Anemia Index	R-a-n-k	% of Childr-en Mode-rately Stunt-ed Index	R-a-n-k	0-14 Sex Ratio Inde-x	R-a-n-k	% of Popula-tion Having Access to Safe Drinkin-g Water Index	R-a-n-k	% age of Popul-ation Havng access to toilets Index	R-a-n-k	Final Sec-urity Inde-x	R-a-nk
1	p	Banteay Meanchey	1.000	1	0.633	18	0.687	9	0.434	19	0.693	10	0.153	21	0.888	2	0.431	18	0.195	12	0.115	11	0.523	6
2	p	Battambang	0.980	2	0.795	11	0.755	5	0.434	19	0.543	13	0.875	2	0.636	3	0.431	18	0.225	9	0.246	3	0.592	12
3	p	Kampong Cham	0.517	12	0.956	4	0.637	14	0.783	12	0.468	19	0.444	11	0.231	14	0.397	22	0.197	10	0.106	12	0.474	16
4	p	Kampong Chhnang	0764	7	0.591	20	0.636	15	0.896	7	0.306	21	0.718	4	0.310	10	0.724	4	0.196	11	0.055	18	0.519	8
5	p	Kampong Speu	0456	14	0.888	7	0.641	13	0.925	4	0.768	3	0.387	12	0.357	9	0.655	5	0.234	8	0.026	22	0.534	4
6	p	Kampong Thom	0.778	6	0.765	13	0.575	17	0.415	21	0.797	2	0.097	22	0.265	13	0.603	8	0.005	23	0.152	8	0.445	18
7	p	Kampot	0.834	3	0.882	9	0.642	12	0.840	11	0.525	15	0.718	4	0.395	6	0.448	16	0.122	16	0.082	16	0.549	3
8	p	Kandal	0.172	19	0.885	8	0.782	3	0.726	15	0.610	11	0.605	9	0.299	11	0.414	20	0.403	5	0.141	9	0.504	10
9	p	Koh Kong	0.157	20	1.000	1	0.611	16	0.311	23	0.750	4	1.000	1	0.000	22	0.828	2	0.404	4	0.174	5	0.524	5
10	p	Kratie	0.313	17	0.658	15	0.686	10	0.538	17	0.745	5	0.367	13	0.136	17	0.448	16	0.360	6	0.156	7	0.441	19
11	m	Kep	0.044	21	0.542	21	0.568	18	1.000	1	0.525	15	0.718	4	0.395	6	0.000	24	0.112	19	0.018	23	0.392	21
12	m	Pailin	0.000	24	0.000	24	0.788	2	0.717	16	0.543	13	0.875	2	0.636	3	1.000	1	0.120	17	0.244	4	0.492	12
13	m	Sihanouk-ville	0.228	18	0.709	14	0.741	6	0.406	22	0.525	15	0.718	4	0.395	6	0.466	15	0.299	7	0.318	2	0.480	14
14	p	Mondol Kiri	0.365	15	0.869	10	0.192	23	0.500	18	0.000	23	0.250	16	0.000	22	0.638	6	0.054	21	0.129	10	0.300	24
15	p	Oddar Meanchey	0.002	23	0.653	16	0.335	22	0.764	13	0.695	8	0.000	23	0.146	15	0.552	12	0.000	24	0.000	24	0.315	23
16	m	Phnom Penh	0.031	22	0.958	3	1.000	1	0.000	24	1.000	1	0.669	8	1.000	1	0.517	14	1.000	1	1.000	1	0.718	1
17	p	Pursat	0.799	5	0.634	17	0.741	6	0.858	9	0.230	22	0.238	18	0.296	12	0.776	3	0.111	20	0.089	14	0.477	15
18	p	Preah Vihear	0.353	16	0.765	12	0.504	19	0.943	3	0.745	5	0.367	13	0.136	17	0.603	8	0.176	14	0.040	19	0.463	17
19	p	Prey Veng	0.642	10	0.495	22	0.722	8	0.906	5	0.445	20	0.589	10	0.129	20	0.569	10	0.624	2	0.032	20	0.515	9
20	p	Ratanak Kiri	0.488	13	0.993	2	0.000	24	0.906	5	0.000	23	0.250	16	0.000	22	0.638	6	0.028	22	0.099	13	0.340	22
21	p	Siemreap	0.763	8	0.488	23	0.442	21	0.755	14	0.695	8	0.000	23	0.146	15	0.534	13	0.124	15	0.063	17	0.401	20
22	p	Stung Treng	0.537	11	0.908	6	0.475	20	0.877	8	0.745	5	0.367	13	0.136	17	0.414	20	0.195	12	0.162	6	0.482	13
23	p	Svay Rieng	0.752	9	0.603	19	0.779	4	0.991	2	0.513	18	0.238	18	0.126	21	0.569	10	0.547	3	0.085	15	0.520	7
24	p	Takeo	0.823	4	0.921	5	0.680	11	0.858	9	0.558	12	0.185	20	0.439	5	0.379	23	0.118	18	0.032	20	0.499	11

capita deficit of production over consumption. All the other availability indicators were very closely correlated to each other and hence were not included in the index (Appendix 5.1 and Appendix 5.2).

The single indicator included was taken as a proxy for food availability. The production per capita represents local food availability, and food consumption per capita represents, in some respects, food distribution. The higher the deficit in production, the higher will be the risk that low income populations do not receive adequate food during disasters and localised food shortages occur.

The 24 Cambodian provinces were grouped into five categories based on the calculation of the food availability index. The grouping and the maps were generated using the natural breaks in the series with Mapinfo software. Each of these categories was given a different colour in the map. The natural break classified the sub-index into five classes taking the cut off points where the variation was very high. If the variation between the provinces was not high, they will be close together. If some provinces have extreme values in comparison to the others, they appear as a separate category. The relative position of the provinces is explained, according to five categories.

The provinces shown in the shades of green dark green and light green depict the best and better off provinces in respect to food availability, and the provinces shown in the shades of red and brown depict those that are highly vulnerable in terms of food availability. The middle category in yellow, marks the provinces that are moderately good.

The availability index shows that, in terms of adequacy of production, Banteay Meanchey and Battambang are in the best position and appear as dark green in the map. This is followed by Kampot, Takeo, Pursat, Kampong Thom, Kampong Chhnang, Siemreap, Prey Veng, Stung Treng and Svay Rieng in light green on the map. Kep, Phnom Penh and Pailin come out as deficit areas and appear as red on the map, but the deficit in these urban areas is of no consequence, since the production deficit is made up by inflows to keep food availability sufficiently high.

The worst possible province for food availability is Oddar Meanchey. Hilly provinces such as Oddar Meanchey are more likely to face food shortages during disasters and lean months. Other provinces, such as Koh Kong, Kratie and Kandal experience production deficits and are likely to face food shortages during disasters and lean seasons. These provinces are depicted in brown, as the severely food insecure provinces.

The provinces of Preah Vihear, Mondul Kiri, Kampong Cham Ratanak Kiri, and Kampong Speu are in the middle category of moderate availability and are depicted in yellow on the map (Table 5.2 and Map 5.1).

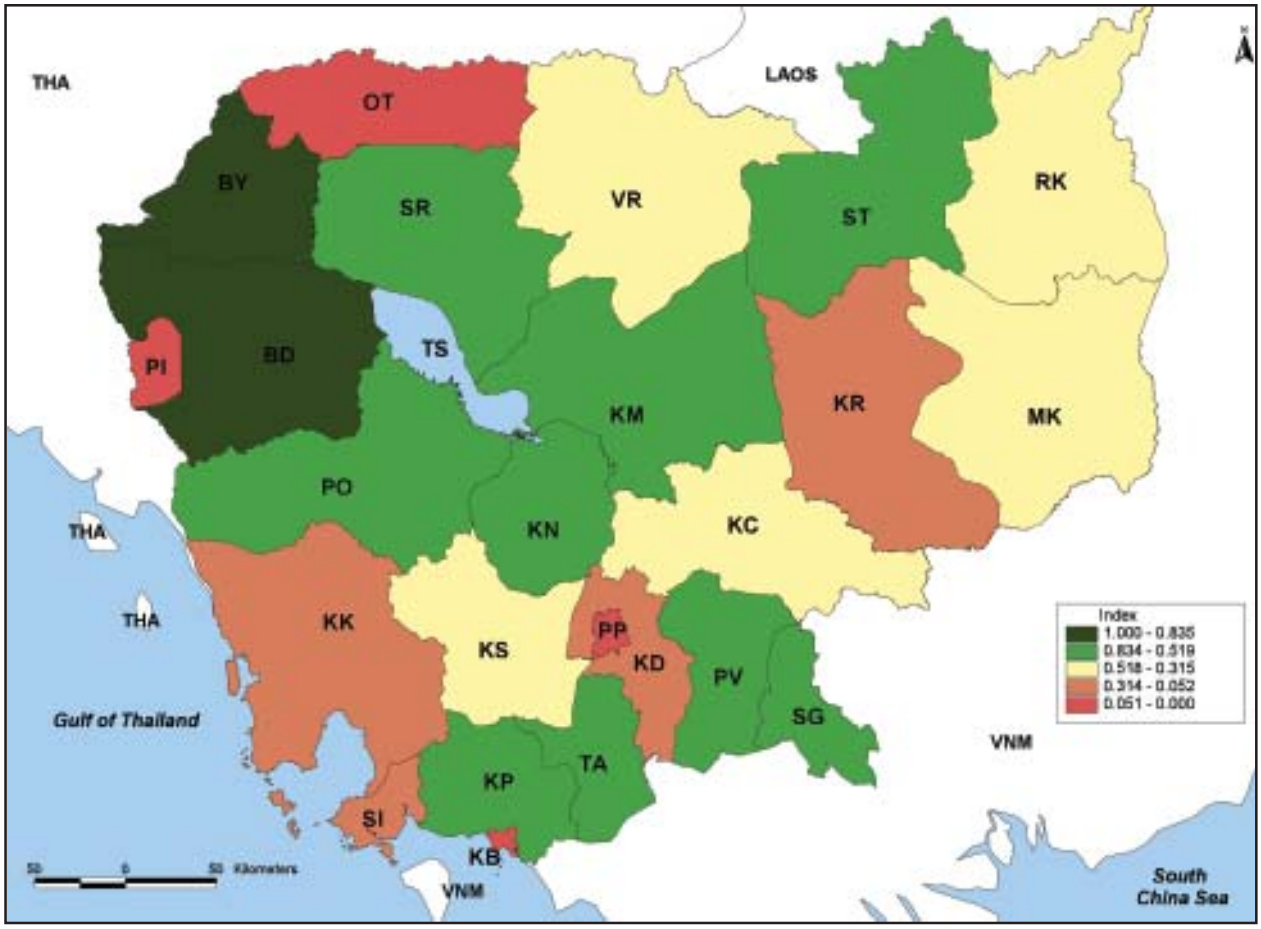
5.3 Composite Map of Food Access

Sixteen indicators have been considered to examine the food access situation. The indicators and the correlations have been studied for their appropriateness before choosing the indicators for inclusion in the index (Appendix 5.3 and 5.4). Due to the high correlations between variables, only three indicators were finally included in the indexing. The percentage of the population below the poverty line, the percentage of literacy and the percentage of unemployment were the three indicators selected for food and livelihood access security. The 24 Cambodian provinces were regrouped into five categories based on the food accessibility status.

Takeo, Kampong Speu, Kandal, Kampong Cham, Svay Rieng and Kampot are seen as having better access to food and livelihoods, and are hence put in a dark green shade on the map. These provinces show lower poverty levels compared to other provinces. The next best category has been depicted in light green on the map. Stung Treng, Pursat, and Preah Vihear are found to be the next best for food access. The poverty levels are lower in these provinces.

The most insecure provinces for food access are shown in red in the map. They are Siemreap, Mondul Kiri and Pailin. The poverty rates and unemployment rates are very high in these provinces, although literacy rates have been lower. The next category of food insecure provinces, in brown colour, consists of

Map 5.1 - AVAILABILITY INDEX



Battambang, Phnom Penh, Koh Kong, Ratanak Kiri, Kratie, Sihanoukville, Kampong Thom, Banteay Meanchey and Oddar Meanchey. Though Phnom Penh and Sihanoukville had the lowest poverty rate and a higher literacy rate, they have been put in the category of food insecure provinces for access to food and livelihoods, since unemployment was very high in both the municipal regions. The migration of people in search of work into Phnom Penh, adds to the number of unemployed. The three provinces in the middle category of moderately food insecure are shown in yellow on the map. They consist of Kampong Chhnang, Prey Veng and Kep. The unemployment rates are very high in these provinces (Table 5.2 and Map 5.2).

5.4 Composite Map of Food Absorption

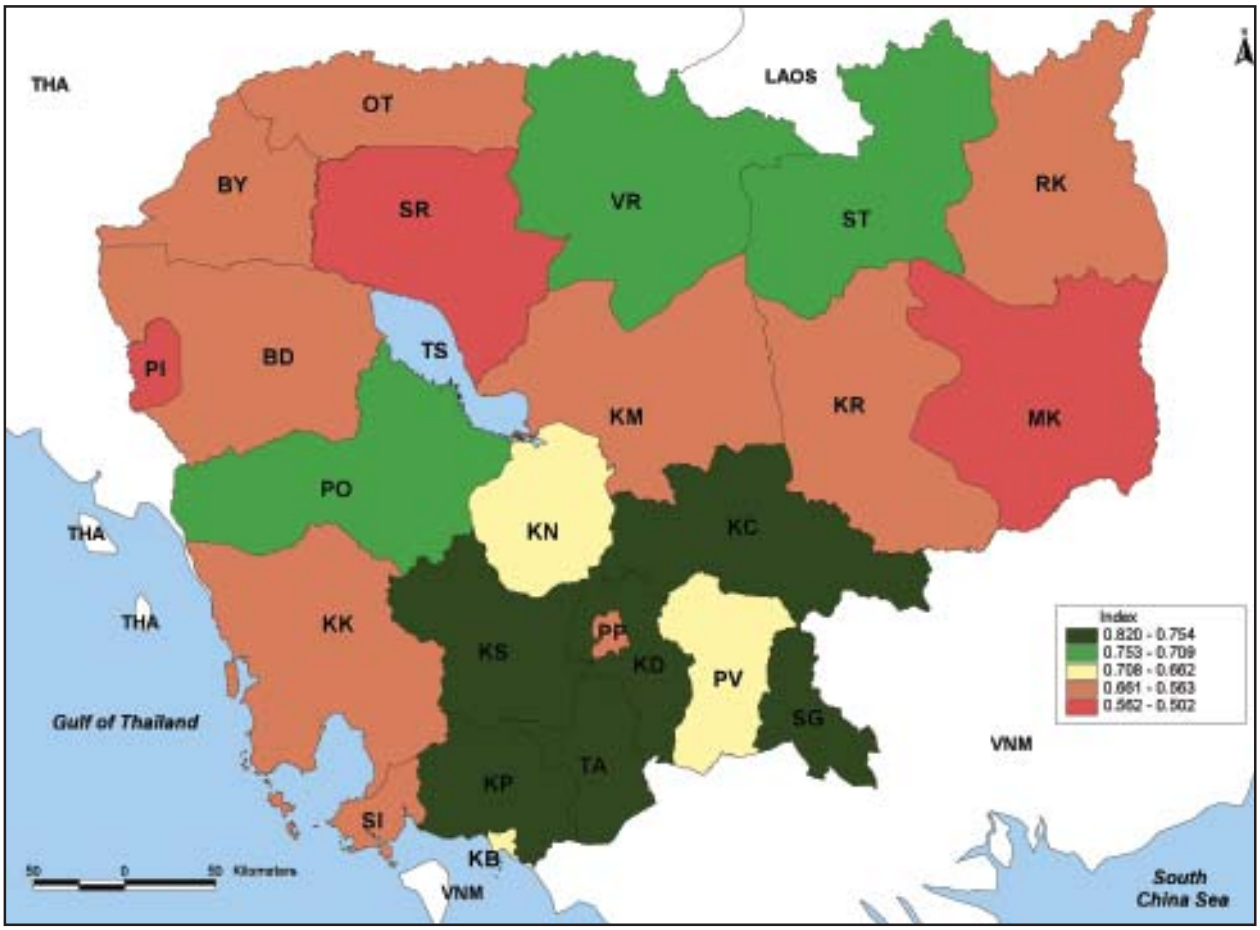
Ten indicators have been identified to assess the food absorption situation. The indicators and their correlations have been scrutinized for inclusion in the absorption index (Appendix 5.5 and Appendix 5.6). As the variables were found to be highly correlated with each other, only six indicators were chosen for the final food absorption index.

The indicators for food absorption are: the percentage of households with access to safe drinking water, percentage of population having access to a toilet facility, percentage of women with anaemia, percentage

Table 5.2 - Availability and Access Index

No.		Province/ Municipality	Per Capita Deficit of Rice Prod. over Consumption(1998)	Deficit/Availability Index	Poverty-Rate	Poverty-Index	Total Literacy Rate	Literacy Index	Total Unemployment Rate	Unemployment Index	Access Sub Index
1	p	Banteay Meanchey	142.93	1.00	40.88	0.63	66.90	0.69	8.00	0.43	0.58
2	p	Battambang	135.62	0.98	26.41	0.80	70.80	0.75	8.00	0.43	0.66
3	p	Kampong Cham	-34.23	0.52	12.07	0.96	64.00	0.64	4.30	0.78	0.79
4	p	Kampong Chhnang	56.22	0.76	44.60	0.59	63.90	0.64	3.10	0.90	0.71
5	p	Kampong Speu	-56.51	0.46	18.18	0.89	64.20	0.64	2.80	0.92	0.82
6	p	Kampong Thom	61.43	0.78	29.07	0.77	60.40	0.58	8.20	0.42	0.59
7	p	Kampot	81.89	0.83	18.67	0.88	64.3	0.64	3.70	0.84	0.79
8	p	Kandal	-160.80	0.17	18.40	0.89	72.40	0.78	4.90	0.73	0.80
9	p	Koh Kong	-166.32	0.16	8.16	1.00	62.50	0.61	9.30	0.31	0.64
10	p	Kratie	-108.99	0.31	38.59	0.66	66.80	0.69	6.90	0.54	0.63
11	m	Kep	-207.68	0.04	48.97	0.54	60.00	0.57	2.00	1.00	0.70
12	m	Pailin	-224.00	0.00	97.24	0.00	72.70	0.79	5.00	0.72	0.50
13	m	Sihanoukville	-140.20	0.23	34.12	0.71	70.00	0.74	8.30	0.41	0.62
14	p	Mondul Kiri	-89.98	0.37	19.87	0.87	38.20	0.19	7.30	0.50	0.52
15	p	Oddar Meanchey	-223.40	0.00	39.05	0.65	46.50	0.34	4.50	0.76	0.58
16	m	Phnom Penh	-212.55	0.03	11.92	0.96	85.00	1.00	12.60	0.00	0.65
17	p	Pursat	69.36	0.80	40.74	0.63	70.00	0.74	3.50	0.86	0.74
18	p	Preah Vihear	-94.47	0.35	29.06	0.77	56.30	0.50	2.60	0.94	0.74
19	p	Prey Veng	11.43	0.64	53.14	0.50	68.90	0.72	3.00	0.91	0.71
20	p	Ratanak Kiri	-45.10	0.49	8.81	0.99	27.10	0.00	3.00	0.91	0.63
21	p	Siemreap	55.85	0.76	53.73	0.49	52.70	0.44	4.60	0.75	0.56
22	p	Stung Treng	-26.99	0.54	16.37	0.91	54.60	0.47	3.30	0.88	0.753
23	p	Svay Rieng	52.02	0.75	43.49	0.60	72.20	0.78	2.10	0.99	0.79
24	p	Takeo	78.09	0.82	15.22	0.92	66.50	0.68	3.50	0.86	0.82
		Max	142.93		97.24		85.00		12.60		
		Min	-224.00		8.16		27.10		2.00		
		Range	366.93		89.08		57.90		10.60		

Map 5.2 - ACCESS INDEX

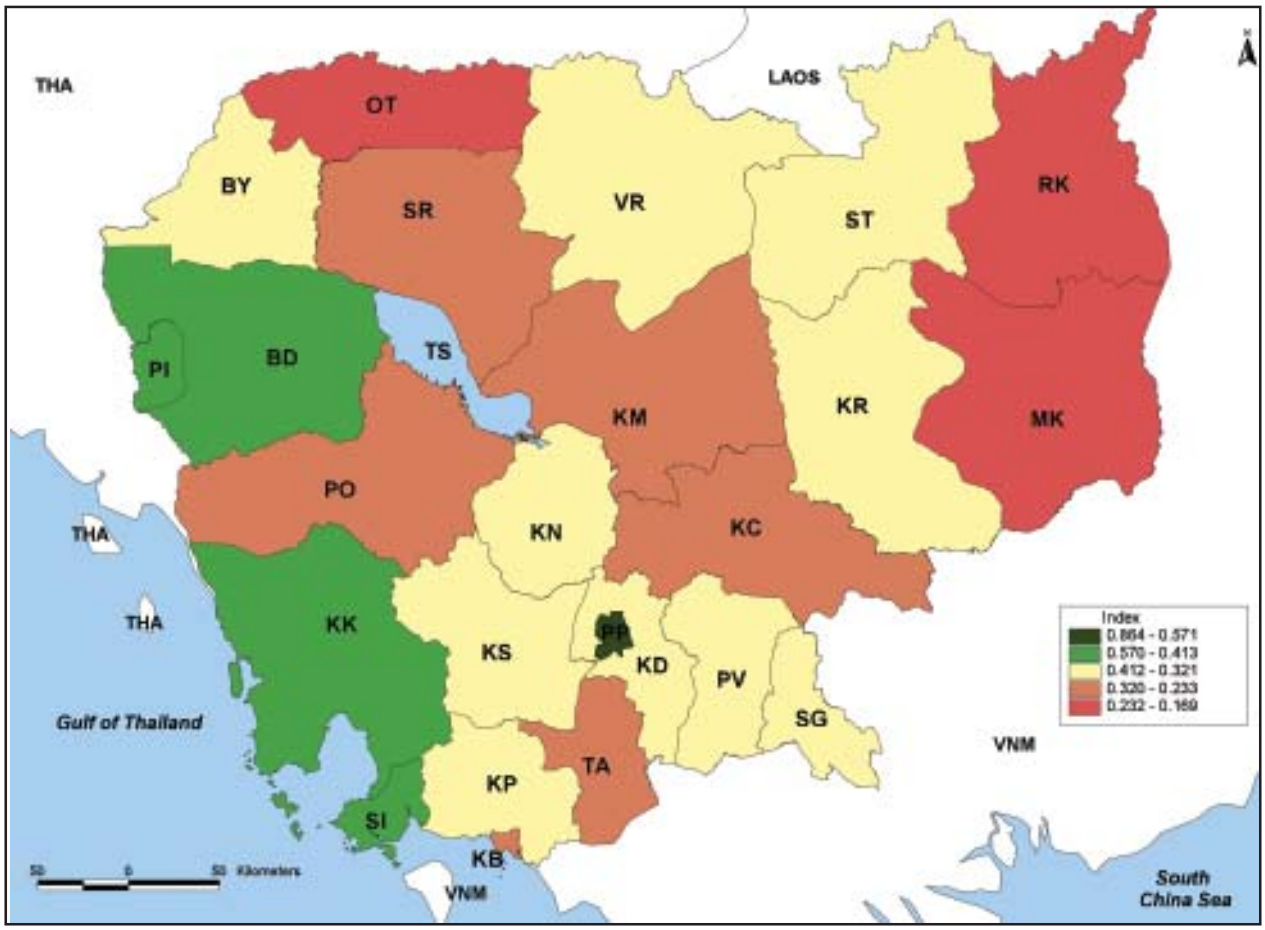


of children below five years who are stunted, sex ratio of the 0-14 age group and infant mortality rates. This index measures the effect of the hygiene and health care outcomes in the population. The relative positions of the provinces have been shown on the map in five categories (Table5.3 and Map 5.3).

The best province in dark green with regard to food absorption, was Phnom Penh. The infant mortality rates were very low compared to other provinces. Phnom Penh had good access to safe drinking water, sanitation and health care. Phnom Penh appeared to be far ahead of all other provinces and municipalities with respect to absorption and nutritional security indicators. It is the only geographical area in this category in dark green. The provinces of Koh Kong, Pailin, Battambang and Sihanoukville have been put in the second category of moderately food secure areas in light green, since they had better access to safe drinking water and sanitation.

The three hilly provinces of Oddar Meanchey, Mondul Kiri and Ratanak Kiri, are the most food insecure and are placed in red on the map, with respect to food absorption and nutritional security. They have a very low index value. One of the reasons for their food insecure position could be the remoteness of these provinces, poor infrastructure and communications and basic services. The six provinces of Kampong Thom, Kampong Cham, Kep, Pursat, Takeo and Siemreap were put in the next to last category of severely food insecure with respect to food absorption and nutritional security. These have been depicted in brown on the food absorption index map.

Map 5.3 - ABSORPTION INDEX



The ten provinces of the middle category of moderately insecure in respect of food absorption and nutritional security were Banteay Meanchey, Kandal, Kampong Speu, Prey Veng, Kampong Chhnang, Kampot, Kratie, Svay Rieng, Preah Vihear and Stung Treng. The nutritional status of children and women is comparatively poor in these provinces.

5.5 The Final Food Security Index and Map of Cambodia

The 24 provinces have been put into five typologies, based on the calculated Composite Index of Food Security. The 24 provinces have been categorised into five categories, as explained earlier, with the help of GIS software that follows the natural breaks in the series. The final food security index, which is the average of ten individual indices of ten chosen indicators, as described previously, ranges from 0.718 to 0.30. Phnom Penh is the only province that falls between the class intervals of 0.592 and 0.718, which indicates that it is most food secure. The next typology consists of moderately food secure provinces and the class limits are 0.5 and 0.592. Kandal, Prey Veng, Kampong Chhnang, Svay Rieng, Banteay Meanchey, Koh Kong, Kampong Speu, Kampot and Battambang fall into this second category of moderately food secure and are depicted in light green on the map.

All the provinces that are extremely food insecure are put in the class below 0.34. Mondul Kiri, Oddar Meanchey and Ratanak Kiri are the provinces

Table 5.3 - Absorption Index

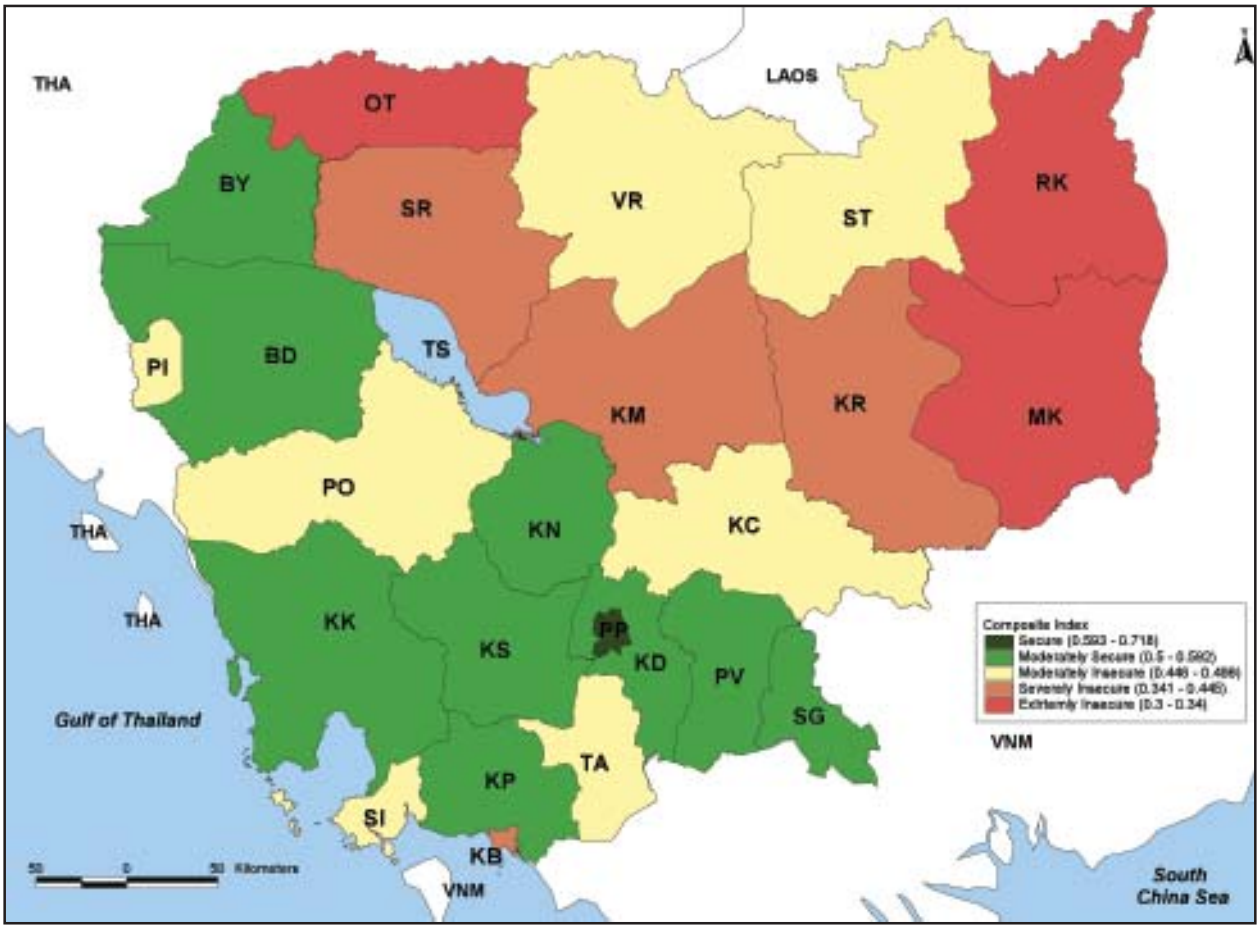
No.	Province/ Municipality	Infant Mort-ality Rate	Infant Mort-ality Rate Index	% of Women with Anemia	% of Women with Anemia Index	% of Children Modera-tely Stunted	% of Children Modera-tely Stunted Index	0-14 Sex Ratio Male/ Female	0-14 Sex Ratio Male/ Female Index	% of Population Having Access to Safe Drinking Water	% of Population Having Access to Safe Drinking Water Index	% of Popul-ation Having Access to Toilets	% of Population Having Access to Toilets Index	Absorpti-on Index
1	Banteay Meanchey	78.20	0.693	65.40	0.153	28.90	0.888	104.90	0.431	19.20	0.195	10.40	0.115	0.412
2	Battambang	98.00	0.543	47.50	0.875	36.30	0.636	104.90	0.431	21.70	0.225	19.90	0.246	0.493
3	Kampong Cham	107.90	0.468	58.20	0.444	48.20	0.231	105.10	0.397	19.40	0.197	9.70	0.106	0.307
4	Kampong Chhnang	129.30	0.306	51.40	0.718	45.90	0.310	103.20	0.724	19.30	0.196	6.00	0.055	0.385
5	Kampong Speu	68.30	0.768	59.60	0.387	44.50	0.357	103.60	0.655	22.40	0.234	3.90	0.026	0.404
6	Kampong Thom	64.50	0.797	66.80	0.097	47.20	0.265	103.90	0.603	3.60	0.005	13.10	0.152	0.320
7	Kampot	100.40	0.525	51.40	0.718	43.40	0.395	104.80	0.448	13.20	0.122	8.00	0.082	0.382
8	Kandal	89.20	0.610	54.20	0.605	46.20	0.299	105.00	0.414	36.30	0.403	12.30	0.141	0.412
9	Koh Kong	70.70	0.750	44.40	1.000	55.00	0.000	102.60	0.828	36.40	0.404	14.70	0.174	0.526
10	Kratie	71.30	0.745	60.10	0.367	51.00	0.136	104.80	0.448	32.80	0.360	13.40	0.156	0.369
11	Kep	100.40	0.525	51.40	0.718	43.40	0.395	107.40	0.000	12.40	0.112	3.30	0.018	0.295
12	Pailin	98.00	0.543	47.50	0.875	36.30	0.636	101.40	1.000	13.10	0.120	19.80	0.244	0.570
13	Sihanoukville	100.40	0.525	51.40	0.718	43.40	0.395	104.70	0.466	27.80	0.299	25.20	0.318	0.453
14	Mondul Kiri	169.80	0.000	63.00	0.250	55.00	0.000	103.70	0.638	7.60	0.054	11.40	0.129	0.178
15	Oddar Meanchey	77.90	0.695	69.20	0.000	50.70	0.146	104.20	0.552	3.20	0.000	2.00	0.000	0.232
16	Phnom Penh	37.60	1.000	52.60	0.669	25.60	1.000	104.40	0.517	85.40	1.000	74.90	1.000	0.864
17	Pursat	139.40	0.230	63.00	0.238	46.30	0.296	102.90	0.776	12.30	0.111	8.50	0.089	0.290
18	Preah Vihear	71.30	0.745	60.10	0.367	51.00	0.136	101.60	0.603	17.70	0.176	4.90	0.040	0.345
19	Prey Veng	111.00	0.445	54.60	0.589	51.20	0.129	104.70	0.569	54.50	0.624	4.30	0.032	0.398
20	Ratanak Kiri	169.80	0.000	63.00	0.250	55.00	0.000	103.70	0.638	5.50	0.028	9.20	0.099	0.169
21	Siemreap	77.90	0.695	69.20	0.000	50.70	0.146	104.20	0.534	13.40	0.124	6.60	0.063	0.261
22	Stung Treng	71.30	0.745	60.10	0.367	51.00	0.136	105.00	0.414	19.20	0.195	13.80	0.162	0.336
23	Svay Rieng	102.00	0.513	63.30	0.238	51.30	0.126	104.10	0.569	48.20	0.547	8.20	0.085	0.346
24	Takeo	96.00	0.558	64.60	0.185	42.10	0.439	105.20	0.379	12.90	0.118	4.30	0.032	0.285
	Max	169.80		69.20		55.00		107.40		85.40		74.90		
	Min	37.60		44.40		25.60		101.60		3.20		2.00		
	Range	132.20		24.80		29.40		5.80		82.20		72.90		

that fall in this last category and are depicted in red on the final food security index map. The severely food insecure provinces, in the next to last category, have an index value between 0.34 and 0.445. The provinces of Kep, Siemreap, Kratie and Kampong Thom are in this next to last category of severely food insecure and are depicted in brown. The remaining provinces of Preah Vihear, Kampong Cham, Pursat, Sihanoukville, Stung Treng, Pailin and Takeo fall in the middle typology of 0.445 to 0.5. They are moderately food insecure and are depicted in yellow in the final map. (Table 5.1 and Map 5.4).

The food security map of Cambodia provides an overall picture of the food security situation at the province level. The map is an advocacy tool and is meant to heighten peoples' awareness of food security concerns. However, the food security map does not reveal a full picture of food security in a province at a glance. For this, it is necessary to go individually through the series of maps and indices, as well as the interrelationship between each of the three dimensions of food availability, food access, and food absorption in order to understand the complex situation of food security. However, a map is a good beginning.

The map thus captures and summarizes the distribution of a large number of indicators. It shows the typology or categorization of each province, with each typology having certain problems in common. These typologies should be considered not only in the context of the parameters included in the mapping index, but

Map 5.4 - FINAL FOOD SECURITY INDEX



also with the insights gained from the preceding analysis. An attempt to go deeper into the causes of food security within the provinces and districts requires a more in-depth analysis of the characteristics of the geographical entity.

The map lays a greater emphasis on deprivation and vulnerability. Hence, the indicators chosen reflect certain basic minimum needs. This is an important factor to keep in mind while interpreting the map. The map particularly emphasises vulnerable persons and vulnerable situations, and is better suited for programme interventions for the poor and vulnerable sections of the population. The food security map of Cambodia thus highlights the situations that need public action and specific interventions.

A further study, using principal component analysis, has also been undertaken to examine the clustering and component categorisation of the indicators (Appendix 5.7).

5.6 The Pattern of Food Insecurity

The map clearly shows that, on the whole, Mondul Kiri, Oddar Meanchey and Ratanak Kiri are the most food insecure provinces in all aspects. They are 'poor' in terms of almost all the indicators, probably because the habitations are in remote areas and cannot be easily reached. They are hence neglected. The most food secure province is Phnom Penh. This province scores high in terms of most of the indicators that carry weight in the index. There are moderately food secure provinces, such as Kandal, Prey Veng, Kampong Chhnang, Svay Rieng, Banteay Meanchey, Koh Kong, Kampong Speu, Kampot, Battambang, and severely food insecure provinces, such as Kep, Siemreap, Kratie and Kampong Thom. Thus, these seven provinces, the three most food insecure, and the four severely food insecure, should be considered as a priority for food security or poverty reduction interventions. However, there is still a need for a further validation of local conditions through intensive surveys to see if the recommendations suit these regions.

Finally, a more complete analysis of the problems of food security would need to give further consideration to the application of indicators and the other factors influencing food security. This would include an analysis of food security at lower administrative levels. It is observed, for example, that the food security classification of the provinces of Prey Veng, Svay Rieng, Kampong Speu and Kep is not fully in line with expectations and would require further examination.

If one were to start with the map and then go beyond each of its indicators, searching for answers to questions, the story of food security would more fully unfold.

CHAPTER 5

Section B

Food Security at the Commune Level

5.7 Commune Level Food Security Index

This section attempts to analyse the commune-level situation. The major limitation of the analysis is that the data used mostly pertains to 1998 and the situation may have changed since then. Six indicators given below were selected for the commune-level index, based on the availability of data:

1. Per capita production of cereals (grams/kg) (2004);
2. Percentage of the population below the poverty line (1998);
3. Percentage of adult literacy (1998);
4. Percentage of children enrolled in school (1998);
5. Percentage of children under five who are underweight (1998); and
6. Percentage of children under five who are stunted (1998).

To observe the situation at the commune level for each of these six indicators, the communes were categorised into five groups, based on the natural break in the data series of each indicator. The best and worst situations and the number of communes in each category are described. These categories were also mapped.

5.7.1 Per Capita Production of Cereals (gms/day)

Rice and maize production were grouped together and the per capita production for cereals was taken as an indicator of availability. This represents the levels of currently assured and demonstrated production. It is noted, however, that the sustainability of agricultural production depends upon the state of natural resources, such as land, water and forests. The health of natural resources is very difficult to assess for the commune as a whole. Data on the ecological functions of natural resources in the ecological sub-regions was not available.

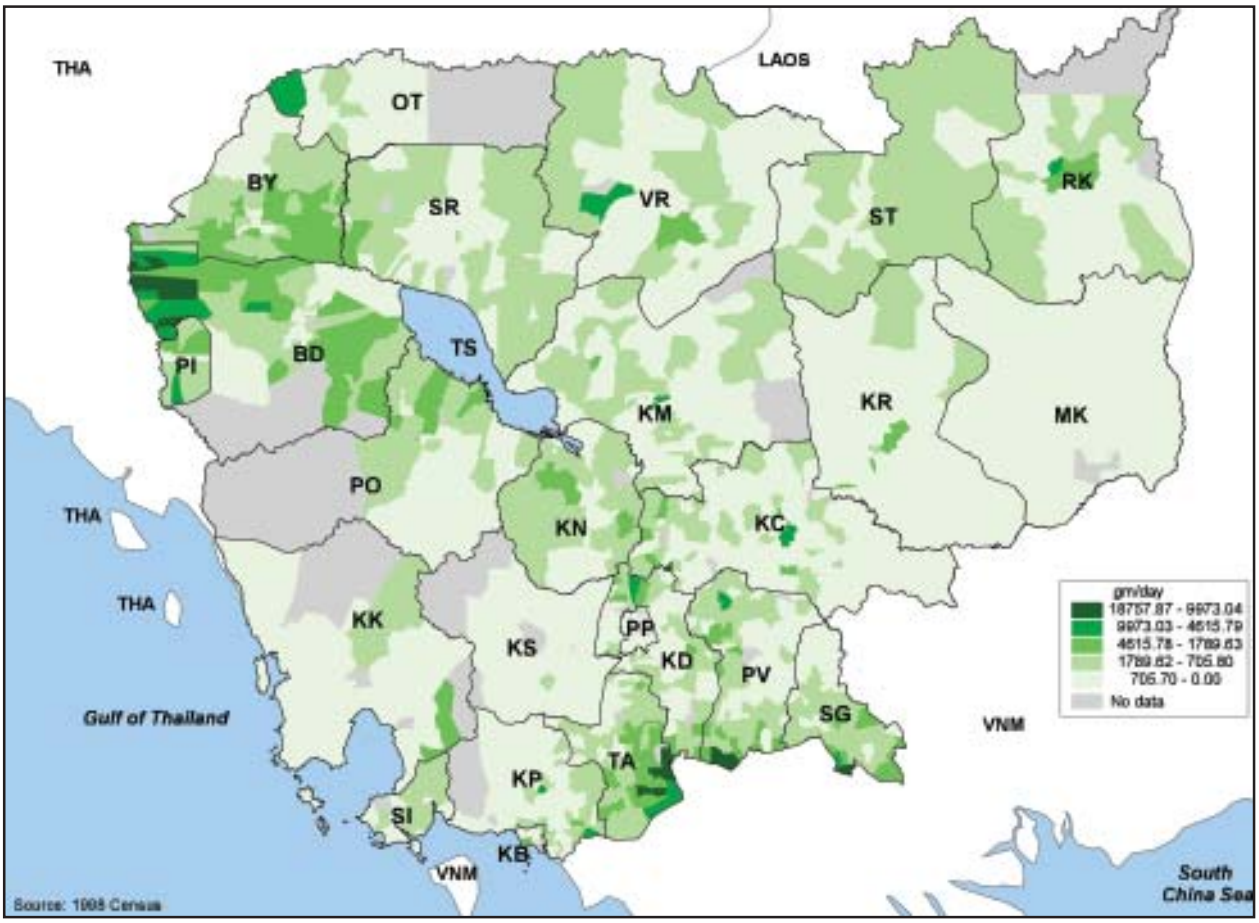
The number of communes for which the data was available for all indicators was only 1,510. Only these communes were considered for the analysis. Out of this data set, 822 communes fell in the first category where the production per capita was low. Around 54.4% of the communes were very poor in cereal production. There were only 11 communes where the production of cereals was very good (close to 10,000 kg per capita per year). This constitutes less than one percent of the total communes. The first three categories, which represent a comparatively poor production of cereals, constituted around 97.5% of the communes. The analysis does not reflect the adequacy of cereal production. It only shows that the per capita cereal production was not very high in these communes, compared to the per capita production of other

communes. This indicator also reflects the state of agricultural activity in the commune. The per capita cereal production was negatively correlated with the percentage of the population below the poverty line at the commune level. This means that when the per capita cereal production is high, poverty levels are low. This is an expected relationship since more local production not only means higher consumption but also the possibility of better livelihoods, higher incomes and lower poverty. Hence, adequate local production, or making sufficient food available closer to the places of habitation at affordable prices, should be the main policy target (Table 5.4 and Map C5.1).

Table 5.4 - Status of per Capita Cereal Production by Commune

Class Interval	Category	No. of Communes	%
0 – 705.7	Worst	822	54.4
705.7 – 1789.62	Severely Poor	520	34.4
1789.62 –4615.78	Moderately Poor	132	8.7
4615.78 – 9973.03	Moderately Good	25	1.7
9973.03 – 18757.87	Good	11	0.7

Map C5.1 - PER CAPITA PRODUCTION OF CEREALS



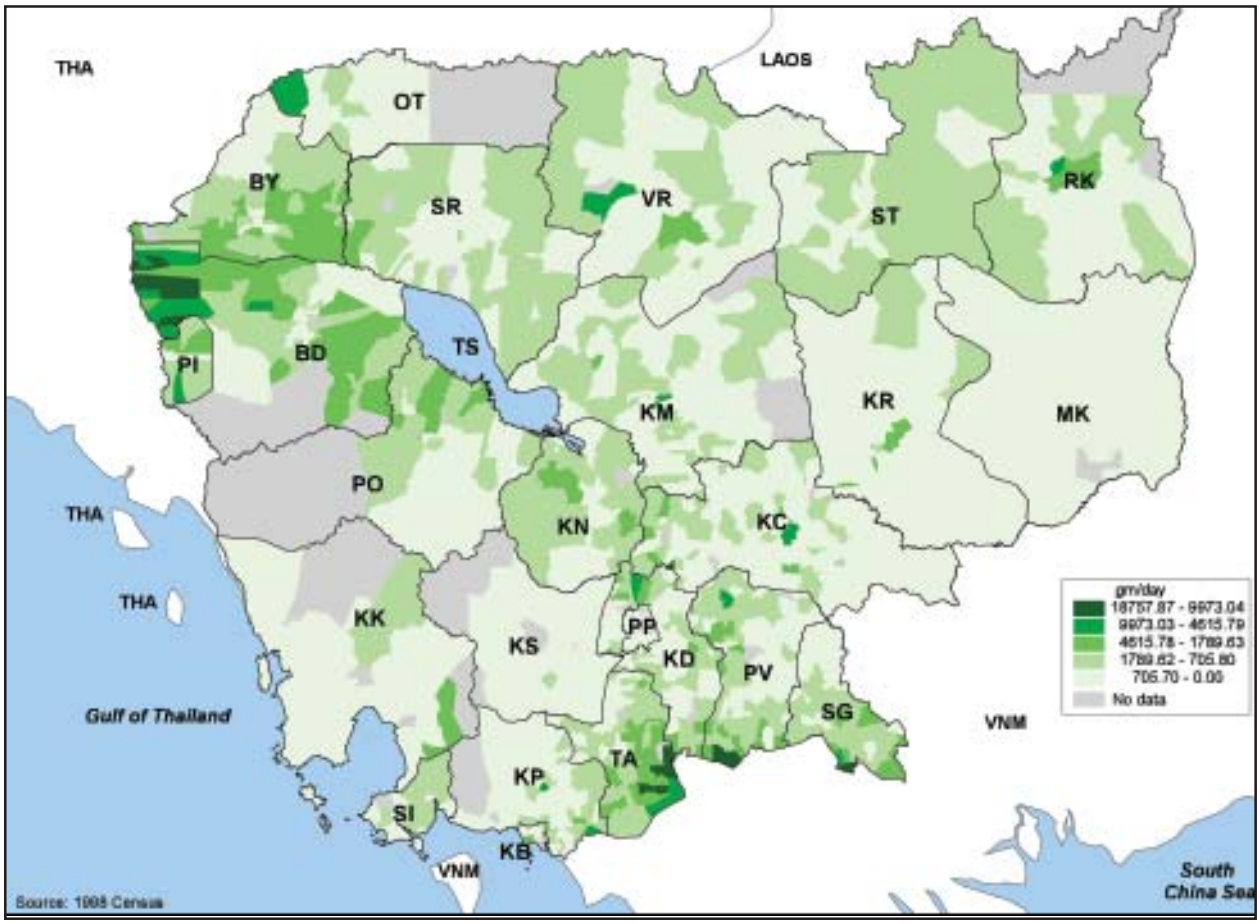
5.7.2 Percentage of Population Below the Poverty Line

The percentage of population below the poverty line is popularly known as the head count ratio. There are 107 communes where the poverty levels are very high. They constitute around 7.1% of the total communes. In the second category, where the poverty levels are slightly better by comparison, there are 290 communes, which constitutes around 19.2% of the total communes. The third and fourth categories, which are in the moderate position, constitute around 875 communes, which is above 55% of the total. There are only 238 communes where the poverty levels are low at around 16%. (Table 5.5 and Map C5.2)

Table 5.5 - Status of Poverty by Commune

Class Interval	Category	No. of Communes	%
0 – 0.19	Good	238	15.8
0.19 – 0.36	Moderately Good	408	27.0
0.36 – 0.53	Moderately Poor	467	30.9
0.53 – 0.74	Severely Poor	290	19.2
0.74 – 0.99	Worst	107	7.1

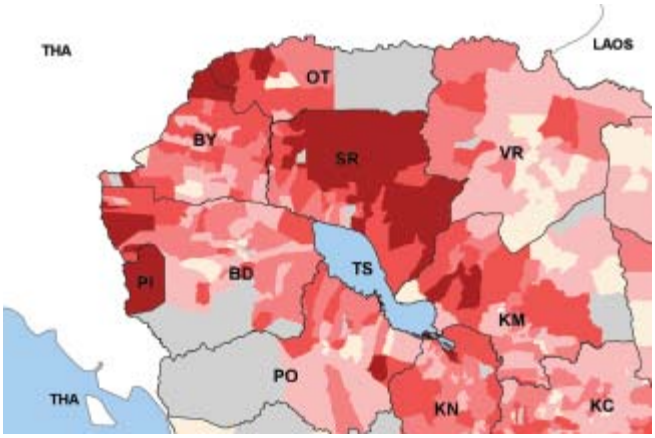
Map C5.2 - PERCENTAGE OF POPULATION BELOW POVERTY LINE



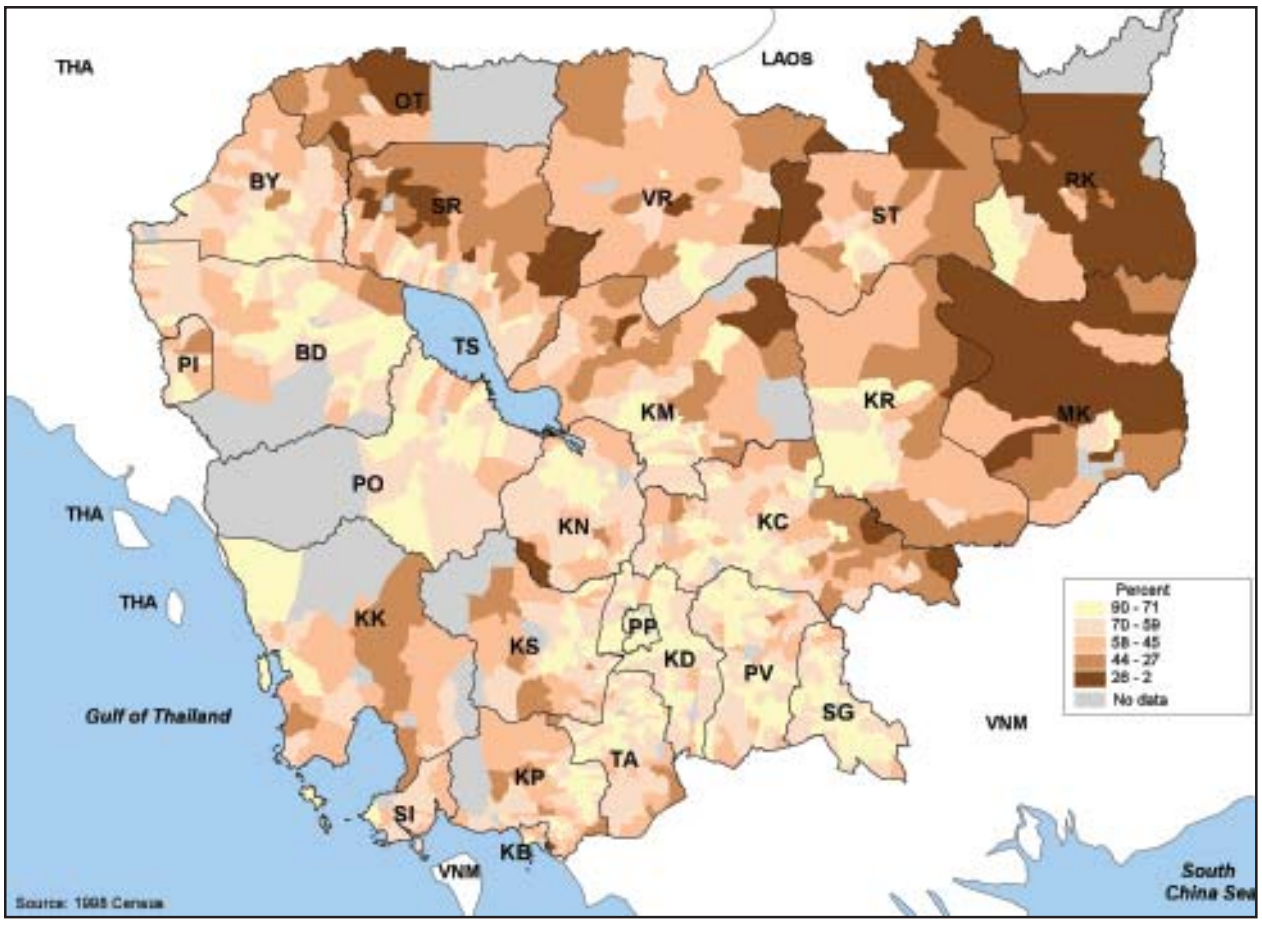
5.7.3 Percentage of Adult Literacy

While literacy is not the sole cause for structural change in employment or alleviation of poverty, it appears to be an important component of it. The level of literacy is also important for better livelihoods, since literate people would have better opportunities.

Only 78 communes have extremely poor literacy, which is around 5%. The next category that represents severely poor literacy levels has 137 communes, which is 9.1%. The moderately poor category of literacy includes 268 communes, or 17.7%. The moderately good category has 438 communes, which is around 29% of the total communes studied. The last category, where the literacy levels are good, covers around 39%, comprising 589 communes. (Table 5.6 and Map C5.3)



Map C5.3 - PERCENTAGE OF ADULT LITERACY



Adult literacy was positively correlated with the percentage of the population below the poverty line, the percentage of children enrolled in school and the percentage of children who were stunted.

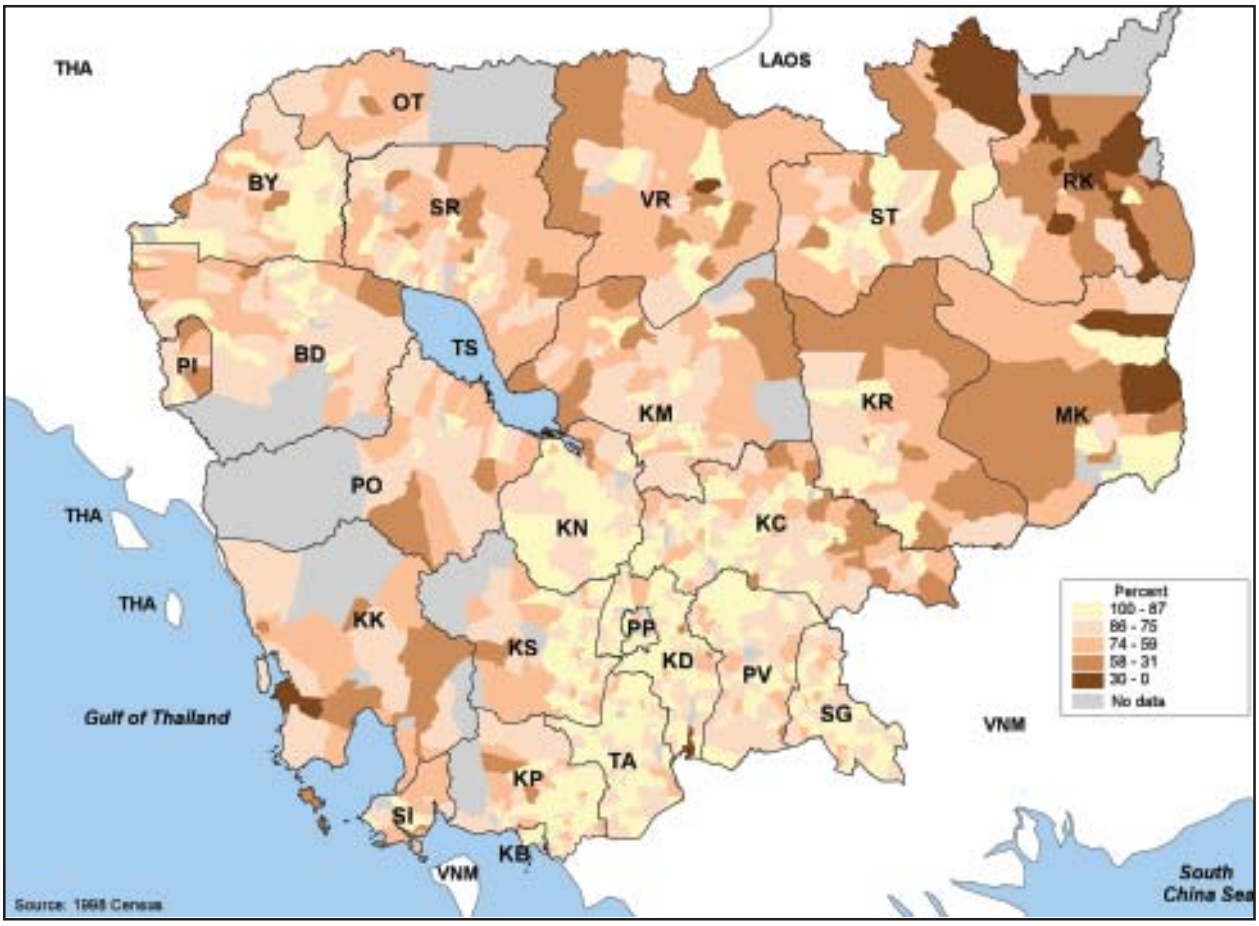
5.7.4 Percentage of Children Enrolled in School

The percentage of children enrolled in school is very good in about 637 communes, which is around 42.2% of the total. In about 470 communes, the enrolment percentage is moderately good, which covers 31%. In 277 communes, or18.3 % of the total communes, the enrolment percentage is moderately poor. The severely poor category has 106 communes. The percentage of enrolment is very low in 20 communes, which is only one percent. This shows that the percentage of children enrolled in school was not very low in the whole of Cambodia. (Table 5.7 and Map C5.4)

Table 5.7 - Status of Children Enrolled in School by Commune

Class Interval	Category	No. of Communes	%
0 – 0.30	Worst	20	1.3
0.3 0 – 0.58	Severely Poor	106	7.0
0.58 – 0.74	Moderately Poor	277	18.3
0.74 – 0.86	Moderately Good	470	31.1
0.86 – 1.00	Good	637	42.2

Map C5.4 - PERCENTAGE OF CHILDREN ENROLLED IN SCHOOL



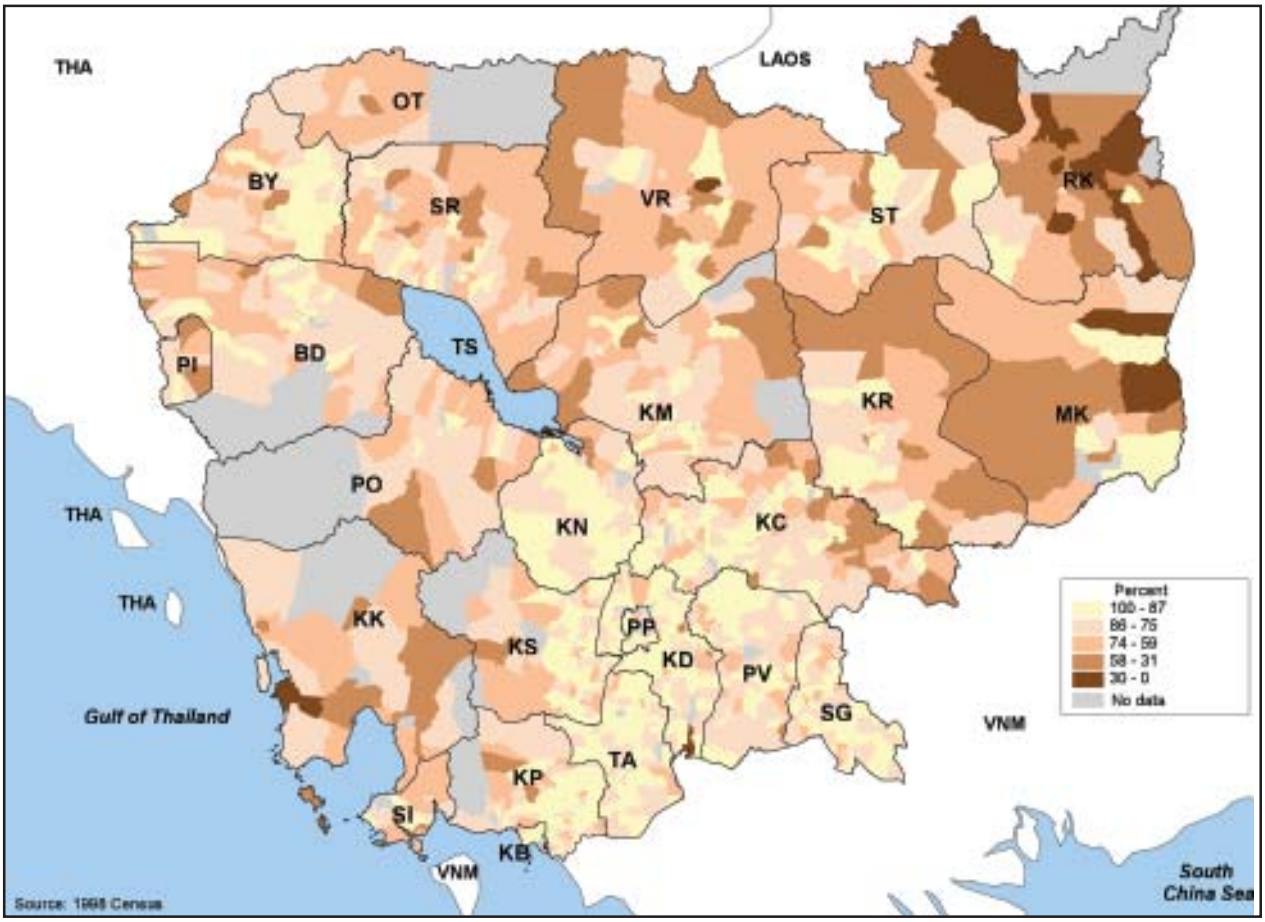
5.7.5 Percentage of Children Who Are Underweight

The undernutrition that occurs during childhood, adolescence, and pregnancy has a negative and additive impact on the birth weight of infants. Growth is the most sensitive and readily measured indicator of health and nutrition for the individual child. It is also a more general index of health in a community because it is dynamic and reflects positive change. Some 173 communes, or 11.5% of the total communes, fall in the best category, with less than 30 percent of children being underweight. The moderately good category has 397 communes, where less than 41 percent of the children are underweight, which constitutes 26.3% of total

Table 5.8 - Status of Underweight Children by Commune

Class Interval	Category	No. of Communes	%
0.10 – 0.30	Good	173	11.5
0.30 – 0.41	Moderately Good	397	26.3
0.41 – 0.51	Moderately Poor	575	38.1
0.51 – 0.63	Severely Poor	273	18.1
0.63 – 0.89	Worst	92	6.1

Map C5.5 - PERCENTAGE OF UNDERWEIGHT CHILDREN



communes. The third category of moderately poor covers 38.1% of the communes, or 575 communes. The severely poor category has 273 communes, which constitutes 18.1% of communes. In this category, more than 50 percent of the children are underweight. The percentage of children who are underweight in the worst off category, comprises 92 communes, which accounts for 6% of total communes. In this category, more than 63 percent of the children are underweight. (Table 5.8 and Map C5.5)

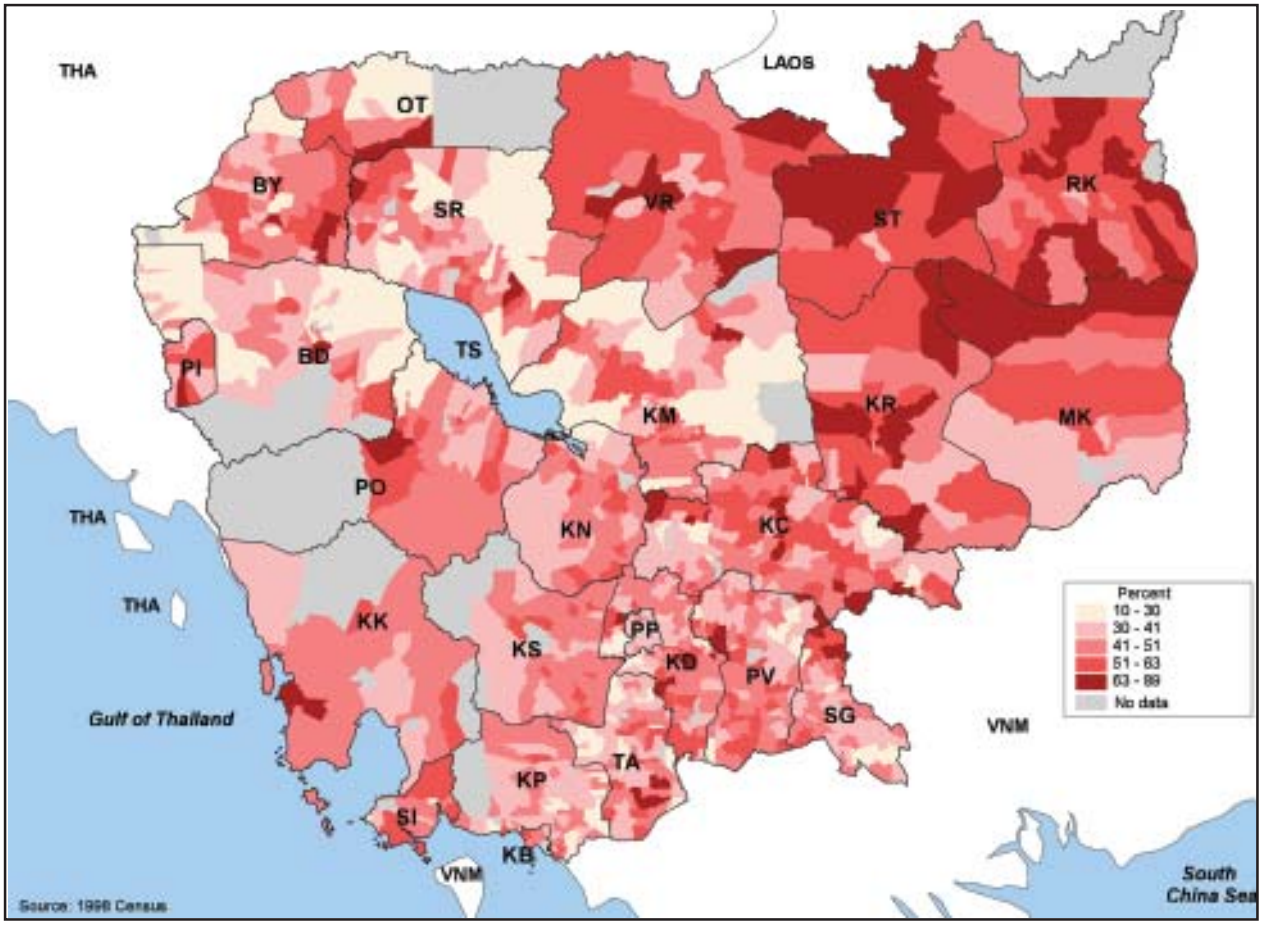
Table 5. 9 - Status of Stunted Children by Commune

Class Interval	Category	No. of Communes	%
0.17-0.33	Good	22	1.5
40.80 - 48.50	Moderately Good	201	13.3
48.50 - 54.20	Moderately Poor	535	35.4
54.20 - 60.23	Severely Poor	536	35.5
60.23 - 76.94	Worst	216	14.3

5.7.6 Percentage of Children Who Are Stunted

Children's body measurements are particularly sensitive to changes in the intake of proteins and calories, as well as the onset of disease. Most growth faltering, resulting in underweight and stunting, occurs within a relatively

Map C5.6 - PERCENTAGE OF STUNTED CHILDREN



short period – from before birth until about two years of age. Stunting is expressed as a standard deviation from the international reference median of height-for-age.

Only 22 communes, that is 1.5% of the total, have a low percentage of children who are stunted. The moderately good category consists of 201 communes, or 13.3% of the total. The moderately poor category has 535 communes, which covers 35.4% of the total. The severely poor category has 563 communes and accounts for 35.5% of communes. The 216 communes categorized as being the worst off, with more tham 54% of the children stunted, covers 14.3% of the total communes. (Table 5.9 and Map C5.6)

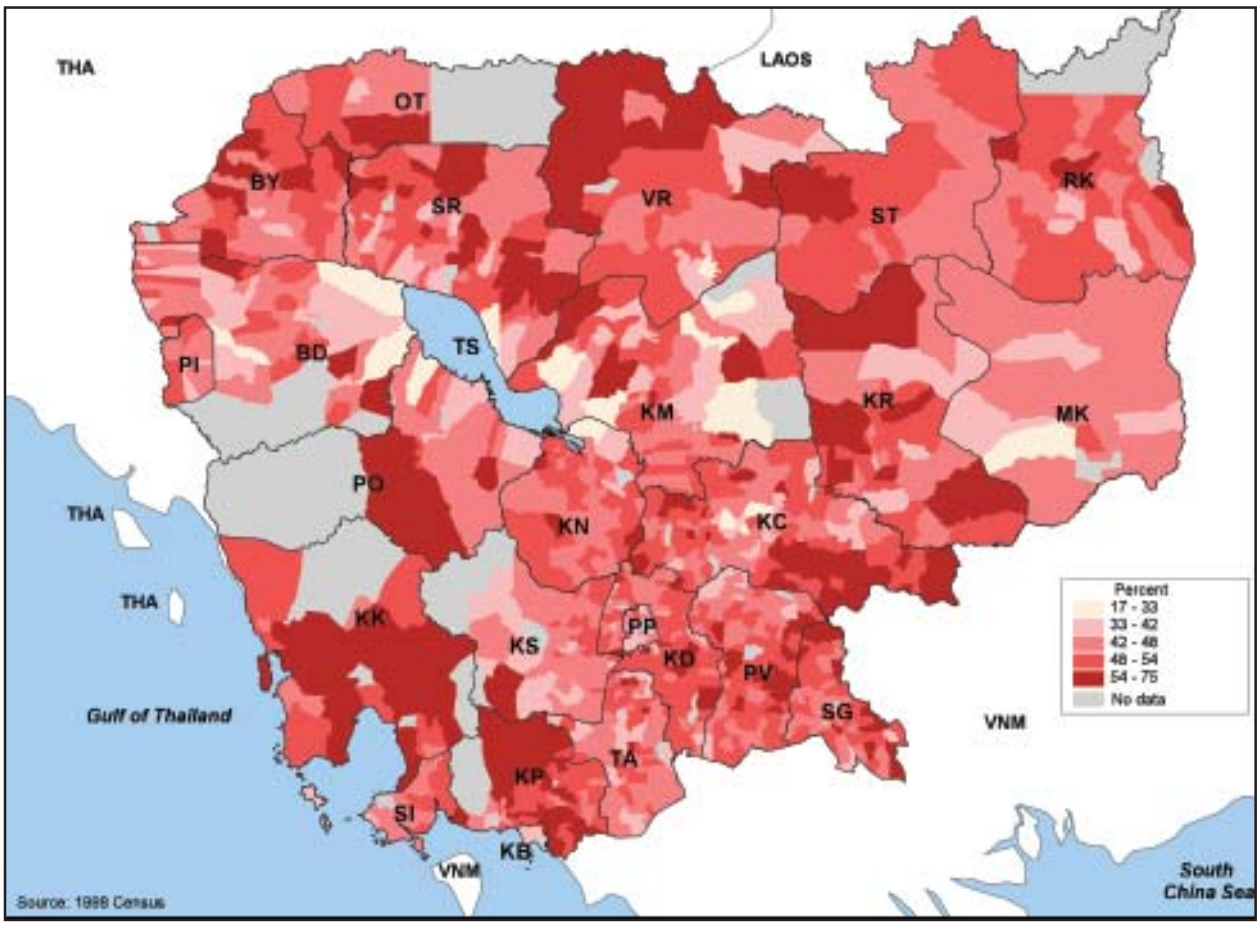
Table 5.10 - Level of Food Security by Commune

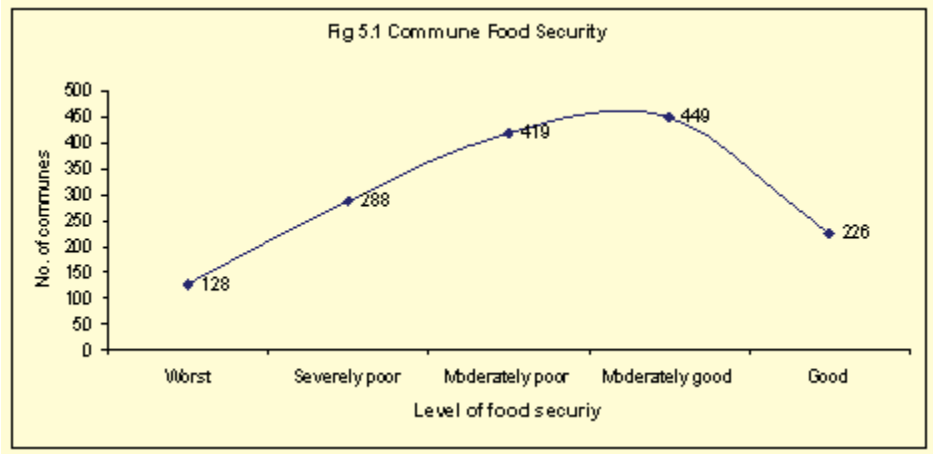
Class Interval	Category	No. of Communes	%
26.47 - 40.80	Worst	128	8.5
40.80 - 48.50	Severely Poor	288	19.1
48.50 - 54.20	Moderately Poor	419	27.7
54.20 - 60.23	Moderately Good	449	29.7
60.23 - 76.94	Good	226	15.0

5.7.7 Composite Index

A composite index was calculated with the above-mentioned six indicators. The indicators were converted into indices, with the average of the indices representing the composite index. The method used was the same

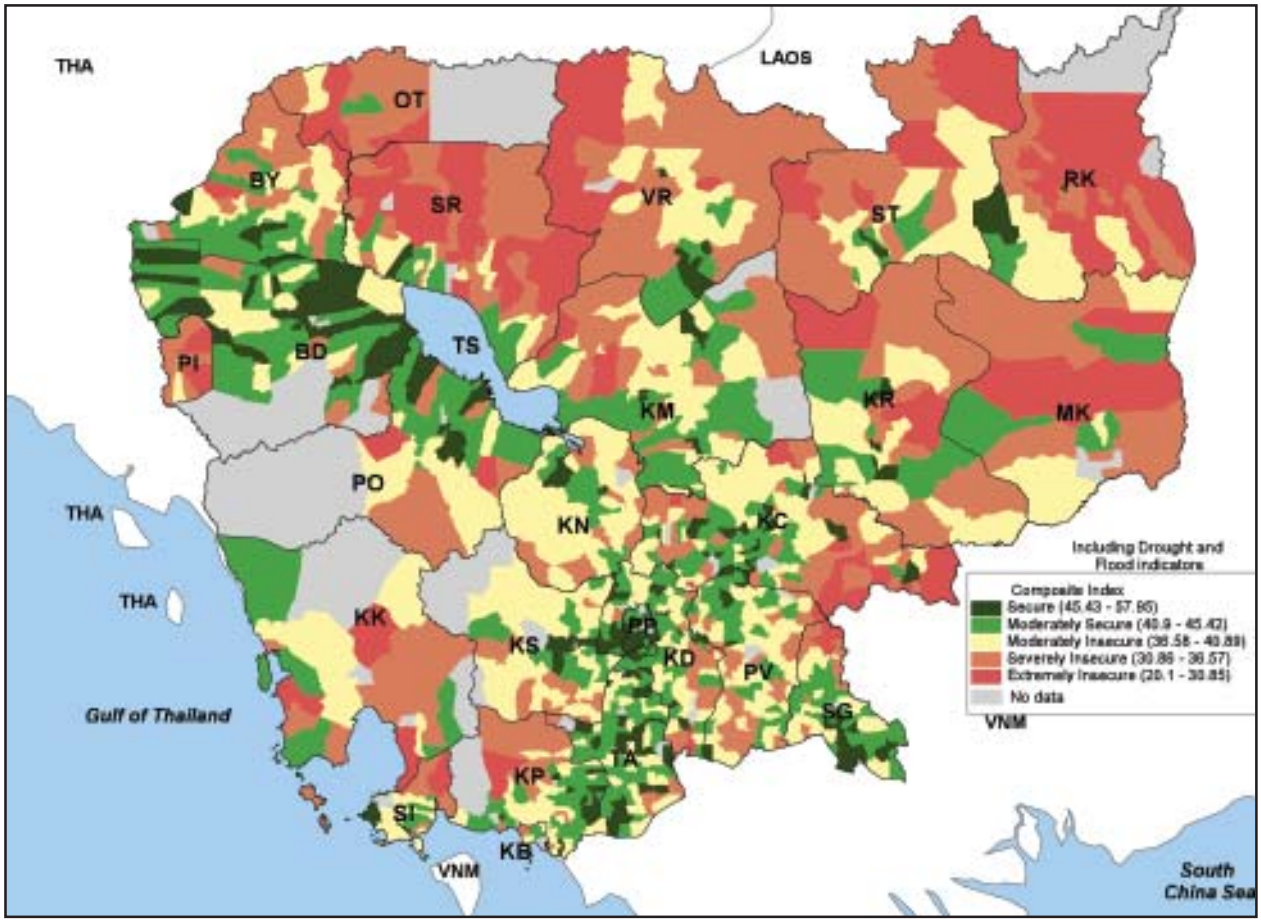
Map C5.7 - COMMUNE LEVEL COMPOSITE INDEX





as the one used in the Human Development Index, described in section one of this chapter. The composite index shows the best and worst communes in terms of food security. (Table 5.10 and Map C5.7)

Map C5.8 - COMMUNE LEVEL COMPOSITE INDEX WITH FLOOD AND DROUGHT



Some 128 communes have been categorized as extremely food insecure, which constitute 8.5% of total communes. The second category of severely insecure has 288 communes, covering 19.1%. The third category of moderately insecure has 419 communes, which is 27.7%. The fourth category of moderately food secure includes 449 communes, or around 29.7% of total communes. There are only 226 food secure communes (15.0%). This shows that food security at the commune level is not satisfactory, which may be due to various province-level factors. (Fig.5.1)

The inclusion of two extra indicators for drought and flood in the index did not make a substantial difference to the final food security index. The main reason is that a large area of Cambodia is shown as not being affected either by flood or by drought, which in this exercise is considered the best category of communes. The other categories are based on whether they had drought or flood. However, the data does not give us either the area affected by flood and drought or the size of the affected population. In the absence of this information, the analysis simply gives a binary result, 0 (zero) if they are not affected and 1 (one) if they are affected by floods or droughts, which does not clearly capture the impact of these events. Hence, the inclusion of these two indicators made very little difference to the final index and the distribution of communes among the various categories of food security. (Table 5.11 and Map C5.8)

Table 5.11 - Composite Index with Flood and Drought

Class Interval	Category	No. of Communes	%
20.10 – 30.85	Worst	128	8.5
30.85 – 36.57	Severely Poor	287	19.0
36.57 – 40.89	Moderately Poor	422	27.9
40.89 – 45.42	Moderately Good	448	29.7
45.42 – 57.95	Good	225	14.9

CHAPTER - 6

Policy Implications

CHAPTER 6

Policy and Programme Implications

This chapter on policy implications is in three parts. The first part indicates the main areas that need intervention. The second part provides an overview of the existing policies and programmes of the Royal Government of Cambodia. The government's own documents are the main source of information for the second part. The third part provides some recommendations. It is noted that policy evaluation is beyond the scope of this study and is not attempted.

This section draws on the strategy documents of several agencies, such as the Asian Development Bank (ADB), the World Bank, the International Monetary Fund, the Hunger Task Force and a number of other international agencies. The recommendations of this study are not significantly different from the government's own strategies. However, they emphasise the need to give immediate attention to a number of well-defined programmes to tackle hunger and deprivation in Cambodia. The recommendations are limited to agricultural production and productivity, safety nets for the poor, and enhancing physical access to food, nutrition, health care and sanitation.

6. 1 Areas of Intervention

6.1.1 Interventions that could enhance sustainable food availability

The analysis of the second chapter shows that, while production of rice is adequate for the country as a whole, there is considerable scope for enhancing its production and the productivity of small farmers. Moreover, there is a need to improve access to food, as well as livelihoods. The Royal Government of Cambodia has stated that a priority is to be given to increasing rice production.[117]

Yield Improvement

*A viable poverty reduction strategy would involve improving yields on existing rice areas. Strategically, the enhancement of rice production on labour intensive small farms helps increase production and reduce poverty. Rice production technology is largely scale neutral and hence it is possible to make small farmers adopt appropriate high yielding varieties of rice. While technology per se is scale neutral, it requires a certain critical minimum investment in resources per hectare, in addition to the labour input. These resources should be made available to the farmer in an integrated manner, as has been done in many Asian economies, including Thailand. The adoption of improved varieties would be easier if input-technology-credit-output-market integration is ensured. [118]

*For productivity enhancement, seed, but also water, is important to grow a second crop. Irrigation levels are at present low in Cambodia. Ground water use through tube wells provides protective irrigation. It is one of the feasible low cost methods of providing small-scale irrigation. Water resource management at watershed level also requires more

[117]Ministry of Planning "Cambodia Millennium Development Goals Report" Kingdom of Cambodia, November 2003.

attention. The possibility of using surface water from rivers and lakes in the dry season through lift irrigation systems and field channels may be considered as a small and medium-sized irrigation project option. Irrigation water could be given free for a few seasons and the costs recovered as production picks up and markets are assured.

*A number of technologies of moisture conservation, such as raised bed planting, alternate wet and dry periods, instead of standing water, are available to enhance yield in a sustainable manner. The System for Rice Intensification (SRI) is another promising technique. A number of technologies using combined organic and chemical fertilizer are also available for sustaining soil fertility.

Provinces to target

*It is important to understand the production potential of rice ecosystems in Cambodia at the province level in order to improve the per hectare productivity of Cambodia. The purpose of such an exercise at the province level would be to identify the provinces of Cambodia that could be selected for priority action. While replacing the traditional low yielding varieties with high yielding varieties, an important consideration has to be balancing nutritional and cultural requirements and the requirements of in-situ conservation of local rice varieties. Simultaneously increasing the net per hectare food production with the help of high yielding varieties provides a marketable surplus to the farmer. This could be achieved by retaining 1/4th of the land area under local varieties and replacing 3/4th of the land area with improved varieties.

*Based on our analysis of the situation in the previous chapters, four provinces have been identified that fall into the low yield-high spread category. They are Kampong Speu, Prey Veng, Siemreap, and Svay Rieng. They have substantial areas under shallow water wet season rice cultivation (also known as rain-fed lowland wet season rice), deep water rice cultivation and upland rice cultivation. Only the provinces of Kampong Speu and Siemreap have shallow water dry season rice cultivation (also known as lowland rain-fed-irrigated rice). Together they form close to 1 million hectares of rice cultivation. This area represented roughly 54 percent of the total rice harvested area in 1998.[119]

*Out of the above four provinces, Svay Rieng holds the maximum potential for improvement in total rice production. This is also a province with widespread poverty, a fair to good literacy rate and a large percent of female-headed households. Hence, it could be selected for an Intensive Area Development Project.

Forests

*Information is not available on dense forest areas. There is a likelihood that dense forest was severely depleted by heavy logging in the mid-nineties. Hence, an option exists to give further attention to forest regeneration programmes. Necessary investments and expertise could come from donor agencies, along with long-term loans. Forests are still being exploited for fuel wood and housing, with no comprehensive regeneration plan at present. Both national economic gains and local sustainability would be achieved by forest rehabilitation.

6.1.2 Interventions to Enhance Food and Livelihood Access

The analysis of Chapter three makes it abundantly clear that the farming community is the poorest in the country. The inadequate land base per household and the low productivity of the staple crops seem to perpetuate the poverty of the small and marginal landholders. Among these households, female-headed households are the

[118]This was the strategy adopted by India in the sixties and seventies to enhance production under Intensive Area Development Programme. All inputs, seed, agricultural extension and ready markets have been offered to the farmers as a package, and positive results were seen in the plains of northern and southern India. The waterlogged areas of eastern India took longer, but adoption was quick soon after the problems of drainage were solved. The technology at present in the 21st century is far superior to what India had at that time. The Cambodia Rice Research Institute and IRRI could work together to achieve this goal. All the relevant institutions are available in the country. IRRI may have released some varieties suitable for Cambodia.

[119] Source: http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp

more vulnerable in terms of assets. The problems of the farmers range from an unviable land base, fragmentation of the land, low yields per hectare, to instability in production. The analysis also shows that the category of landless labour are the poorest and also face hunger and deprivation during the lean season. The subsistence farmers are not much better off. Even those with marketed surpluses face problems of seasonal shortages of food, due to low earnings. Underemployment and disguised unemployment are widespread in rural areas. This is obvious from the huge size of unpaid family labour. The lack of work and income earning opportunities are also apparent. Disasters such as flood and drought make matters worse.

Farm Sector

*Diversification of production to vegetables, fisheries, and livestock, with market links is an important area of intervention. Assured markets at remunerative prices for produce is another area that needs immediate attention.

*Generous availability of institutional credit at reasonable rates, linked to production, storage and markets, would relieve rural people from a dependency on moneylenders. Access to institutional credit helps rural poor farmers to hold produce until prices recover.

*There is a need for interventions to provide "food safety nets" to those in rural areas in lean months, especially to vulnerable poverty groups.

*In the event of disasters, relief assistance may also be given to preserve the human and physical assets of the vulnerable poor.

*As has been recommended by the Hunger Task Force, food safety nets in rural areas may give a priority to the purchase of local grain to provide market support.

Education

Cambodia has done very well in the areas of primary education and literacy. Literacy appears to open up avenues of employment outside agriculture to many.

More attention needs to be paid to functional primary education, secondary education and vocational training. The skills demanded in Southeast Asia should be considered when designing training programmes. This would provide a base for foreign direct investment in the years to come. Training could be negotiated and linked to specific foreign direct investment if the investment climate improves.

Governance

To provide effective safety nets, a committed civil service is essential. The quality of governance is cited as a major issue by many studies. One of the root-causes of widespread corruption in Cambodia may be the compulsion to accept money from private parties.[120]

While a large number of people are employed by the government sector, salaries are very low. Hence, there is a tendency to accept money for small and big favours from many parties. Moreover, the government runs the risk of loosing control over its employees and their activities. Hence, innovative mechanisms are required to generate and pool government revenues, as well as to use resources from private parties and external donors in order to enhance the salaries of government employees.

Infrastructure

Cambodia needs massive investments in rural infrastructure, such as roads, electrification, communications, transportation, storage facilities, and markets for rural prosperity and overall development.

[120]There are reasons to believe that receiving money from private parties for the services rendered by government employees is an accepted practice in parts of Southeast Asia.

6.1.3 Interventions to Enhance Food Absorption and Nutrition

Health and Nutrition

Health care and nutrition are critical areas for improvements in food security. Poverty, along with insufficient nutrition, creates a vicious circle for vulnerable populations, which needs to be broken.

*Supplementary nutrition to the poor and target populations of expectant and lactating mothers, and pre-school and school children may be considered as an entry point.

* Health services are under-utilised due to unaffordability. Hence, there is an urgent need to consider innovative funding mechanisms to improve the access of the poor to basic health care. Ideally, primary health care should be provided free of charge, or at least be highly subsidised in rural areas, as in the case of primary education. There is also an important need to better link health and nutrition.

* Potable water and sanitation infrastructure, together with education on the use of facilities, need to be expanded.

Hunger Task Force Recommendations

To reduce hunger, the government must have effective policies that are also properly implemented and executed. Lack of resources and other political, social, technical and institutional factors are all limiting factors. Effective execution requires community-level leadership, participation of donors, and the private sector.

The Hunger Task Force[137]has proposed that the following should be key ingredients of enhanced strategies:

1. Broad participation;
2. Thorough analysis;
3. Sound policy design and integration into existing processes; and
4. Monitoring and public reporting.

Financial constraints can be overcome through a combination of existing public sector resources, official development assistance, private sector investment and contributions from a variety of private organisations. Translating funding for global and national commitments into local action remains the greatest challenge in achieving the goals. The Millennium Development Goals, with corresponding investment needs and financial gaps for Cambodia, have been given by the Hunger Task Force (Table 6.1).

Table 6.1 - Cambodia's MDG Investment Needs

No.	MDG Investment Needs	Value Per Capita in US $ Years		
		2006	2010	2015
1	Hunger	4	7	13
2	Education	15	19	22
3	Gender Equity	2	3	3
4	Health	14	21	32
5	Water Supply and Sanitation	3	5	8
6	Improving the Lives of Slum Dwellers	3	3	4
7	Energy	9	13	23
8	Others	12	21	31
9	Roads	8	9	13
	Total	70	101	149

Source: UN Millennium Project Task Force on Hunger, 2005, "Halving Hunger". It can be done summary version.

[121]Ministry of Planning "Cambodia Millennium Development Goals Report" Kingdom of Cambodia, November 2003.

[122] "Cambodia Millennium Development Goals Report" Kingdom of Cambodia, November 2003.

6.2 Government Policies - Implemented and Planned

With the formation of the new government in July 2004, the Prime Minister introduced the Rectangular Strategy aimed at economic reform and growth of the country. The Rectangular Strategy, 2004-2008, incorporated elements from the Millennium Development Goals (MDGs), the Cambodian Socio-Economic Development Program 2001-2005 (SEDP II) and the Cambodian National Poverty Reduction Strategy 2003-2005 (NPRS). The Rectangular Strategy aims at an average annual real GDP growth rate of 6-7% and requires financing in excess of $1.5 billion over 2003-2005.[121]

The Rectangular Strategy is visualised as a structure of interlocking rectangles. At the core is good governance, focussing on anti-corruption mechanisms, reform of the legal and judicial system, as well as the armed forces, and improving public administrationt.[135] For effective implementation of these and other reforms, what is required is the right environment – peace, macroeconomic stability, and inter and intra regional partnerships. The strategic growth rectangles identified are:

*agricultural sector,

*private sector,

*physical infrastructure, and

*human resource development.

For each of these strategies, there are four sides. In the agricultural sector, issues included land, forestry and fishery reforms, as well as acknowledgement of the need to improve agricultural productivity and diversification. The strategy looks at developing the private sector by promoting a favourable investment climate and encouraging small and medium scale enterprises (SMEs). Finally, the strategy states that human resource development requires enhancing the quality of education and health services, and fostering gender equity.

The 2003-2005 NPRS was adopted as a comprehensive framework that aims at maintaining macroeconomic stability, as well as promoting pro-poor policies to improve rural livelihoods, promote job opportunities, ensure better health and nutrition, reduce vulnerability, improve capabilities, promote gender equity and focus on population concerns.

The 2001-2005 SEDP II is the national strategy that outlines policies and programs that promote economic growth and poverty reduction in the long run. It promotes social development by improving the access of the poor to education, health, water, power, credit, and improving the governance environment through effective implementation of the Governance Action Plan (GAP). Food security in rural areas, and strengthening the legal framework in order to increase personal security and social justice, are central to this action plan. [122]

6.2.1 Food Production and Availability

Crop production, livestock, fisheries and forestry are the sectors that influence food availability. They also represent the incomes of a majority of the population dependant on agriculture. Enhancing agricultural growth is one of the main strategies of the Royal Government of Cambodia. Expansion of rice cultivated areas from 16.6 percent to 20 percent of available land is one of the important aims of government policy. The strategy includes:

I. Expansion of cultivated areas, ensuring safety of land occupation and land utilisation, and preventing illegal and violent land occupation;

II. Establishment of rural finance to provide the needed credit to farmers for buying agricultural inputs;

[123]Royal Government of Cambodia, Ministry of Agriculture, Forestry and Fisheries www.fadinap.org/cambodia/Agplan20012005/chap1_2_8.html

[124]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2005.

III. Direct public investments by using external assistance and increasing private sector development and investment in the agricultural sector;

IV. Strengthening extension services, natural resource utilisation and management, and agricultural techniques to meet the requirements of the domestic market and for exports;

V. Strengthening the sustainable utilisation of fishery resources and increasing support for investment in agro-industries, animal husbandry and fish raising;

VI. Accelerating the pace of privatisation of rubber plantations, assisting private investment companies to invest in large-scale rubber production, and encouraging smallholder rubber plantations

VII. Promoting application of forestry policies and laws on forest management, and promoting planting of fast growing and higher yield trees for utilisation as fuel wood and charcoal; and

VIII. Cooperating with local authorities and other competent bodies to prevent illegal activities and strengthen inspection through administrative penalties.[123]

Future Targets

The agricultural sector development targets for the year 2005 include:

I. A continuing focus on food security, especially at the community and household level, and reducing poverty in the agricultural sector;

II. Increasing food production, especially rice production and subsidiary crops;

III. Increasing the exports of surplus agricultural products;

IV. Improving the quality of agricultural products and increasing value-added production by promoting the development of agro-industrial processing to foster the creation of new jobs for rural areas;

V. Increasing family incomes and reducing poverty by supporting diversified crop production with high yields and low production costs; and

VI. Managing natural resources through regulation and technical measures for sustainable exploitation.

Observations suggest that NPRS and SEDPII budgets provided for only limited expenditure on both agriculture and rural development, amounting to a meagre 2.3% and 1.1%, respectively, in 2003, compared to defence expenditure, which was 22%.[124]

Crop Diversification

The downward drift of rice prices (reaching a historical low in 2001) is bringing greater pressure to bear on the need for greater diversification. Diversification is a crucial aspect of agricultural change, but it is constrained by a host of factors, ranging from soil and water suitability, skill acquisition, capital and labour constraints, risk in marketing, and foremost, by the lack of adequate markets. Information technology can also put producers in more direct contact with export markets.

The government has recognised the important need for diversification. The NPRS states that 'rice production alone will not realise the objective of poverty reduction. Crop diversification, crop rotation and industrial crops need to be developed for smallholders, local industries and export in order to improve value-added and generate income.'[125] The NPRS identifies rubber and vegetable cultivation as potential fields for diversification. Given that the country's domestic demand for vegetables is met by imports from neighbouring countries, there is tremendous potential for diversification in Cambodia. However, the skill and the technology necessary for implementing an effective diversification programme are lacking.

Agricultural Inputs

Apart from pesticides, seeds and research-related activities, irrigation and fertilizers are also important inputs. The fluctuations in fertiliser prices, as well as the problem of availability, make the use of fertiliser highly

[125]Council for Social Development "National Poverty Reduction Strategy 2003-2005" Kingdom of Cambodia 20th December 2002

[126]Royal Government of Cambodia, Ministry of Agriculture, Forestry and Fisheries www.fadinap.org/cambodia/Agplan20012005/chap1_2_8.html.

variable among farmers. This is being addressed by the recently reformed state-owned Central Company of Agricultural Materials (COCMA). It has also provided a fertiliser utilisation formula for 11 different soil types[126] with financial help from the Government of Australia.

Agricultural Extension and Research

The expansion of agricultural extension services is a very important component of increased agricultural productivity. Two new institutions, the Department of Agricultural Extension (DAE) and the Cambodian Agricultural Research and Development Institute (CARDI) were established in the Ministry of Agriculture, Forestry and Fisheries (MAFF) with assistance from AusAID. This support continues through the Cambodia-Australia Agriculture Extension Project. Another programme with JICA is being developed for the establishment of Northwest Agricultural Research and Development activity in five provinces around the Tonle Sap Lake.

Since 1993, the MAFF has been emphasising the development and practice of Integrated Pest Management (IPM) as an alternative to the indiscriminate use of pesticides, particularly on food crops. To date, about 30,000 farmers have been trained in IPM through the Farmers Field School (FFS).[127] This programme has helped the country move towards pesticide use reduction. Pesticide management at the national level is the responsibility of the Bureau of Agricultural Material Standards (BAMS), which was established in 1999, by MAFF, in cooperation with the Department of Agronomy and Agricultural Land Improvement.

The Ministry of Agriculture, Forestry and Fisheries encourages researchers to produce quality seeds and emphasises the need for seed quality control. It is seeking external financial assistance for the distribution of new varieties of high quality rice seed developed by the Cambodia-IRRI-Australia Project (CIAP). However, as the NPRS rightly points out, there is a need for legislation to ensure access of farmers to these seeds, and also to motivate the private sector to invest in this field.

The NPRS envisages the setting up of research systems, to be located in specific agricultural ecosystems wherever feasible. According to the NPRS, these research and extension systems will go beyond increasing the effectiveness of the use of agro-chemicals and improved seeds. Priority will be given to diversification and intensification of sustainable agricultural production.

Fisheries and Aquaculture

As fish is one of the major components in the diet of the Cambodian people, much attention needs to be given to this area. The increased population is exerting a great pressure on the environment, adversely affecting supply side factors. MAFF aims implementing various programmes and policies, in order to bring about greater sustainability in the fisheries and aquaculture sectors. To avoid conflicts between subsistence and small-scale family producers, the government had decided to release 56% of commercial fishing lot areas to local fishing communities for small-scale family fishing. Community fisheries have also been established and strengthened. The fish lot reform ensures sustainable use of natural resources and improves the standard of living of the rural poor.

To meet the growing needs of the population, the Department of Fisheries has identified the possibility of small-scale aquaculture development in rural areas with financial and technical support of the FAO, and other partners. The government has provided extension services and training to farmers in fishpond culture, as well as rice-fish culture in several provinces, including Prey Veng, Svay Rieng, Takeo and Kandal. It is also taking measures to expand small-scale aquaculture to other provinces as a secondary occupation to rice cultivation.

[127]Food and Agricultural Organization "Report of the 22nd session of Asia and Pacific Plant Protection" http://www.fao.org/documents/show_cdr.htm

Livestock

Livestock is another sub-sector that provides income, as well as valuable sources of protein, for rural households. This sector, however, seems to be affected by poor veterinary services and frequent floods. This has posed a serious threat to animal production. The government has adopted a sub-decree on the establishment and management of Village Livestock Workers, which allows the Department of Animal Health and Production (DHAP) of the MAFF to expand its support and linkages countrywide. In order to provide direct assistance to smallholder farmers, the government has focused on animal health services through disease control, strengthening cooperation with international organisations and public veterinary services and research.

Water Resource Development

There is still a substantial unmet need and lack of specific policy guidance on appropriate technologies for the promotion of sustainable water resource use. Food insecurity, resulting from single cropping in the rice areas, creates a further sense of urgency. However, the potential for unwise investments leads to the need for a well-defined strategic policy that addresses the needs of poor farmers through sustainable irrigation schemes, flood control, and watershed management.

The government's goals in this sector are (i) to implement viable irrigation systems based on local cost recovery; (ii) to develop hydropower, focusing on multipurpose projects; and (iii) to increase the domestic technical capacity and databases needed for effective water resource management capacity. The MoWRAM, which is in the process of developing short, medium, and long-term goals, is responsible for irrigation, flood control and drainage and other multipurpose schemes.

Other government ministries are also involved in the water sector. The Ministry of Industry, Mines and Energy (MIME) is responsible for hydropower development, the Ministry of Rural Development (MRD) is responsible for domestic rural water supply, the MAFF is responsible for forestry management in the watershed areas and the Ministry of Environment (MoE) is responsible for the environmental assessment of water resource development projects. Finally, the Cambodian National Mekong Committee coordinates with the Mekong River Commission on water resource management issues of cross-border interest. Thus sustainable water resources use depends upon the coordination of several agencies.

Forestry

Forests represent a valuable resource to Cambodia that need to be conserved. Forestry contributed to around 5% to GDP but has declined in recent years[129]To ensure sustainable management of forest resources, the government has implemented a forest management reform policy. Also, a draft sub-decree on community forestry has been developed through a nationwide, participatory and multi-stakeholder process, which has enhanced local community participation in the forest management decision-making process. This has facilitated initial steps in the development of the forest policy statement and the restructuring of forest administration undertaken by MAFF. This provides the potential for better support to the forest development community.

The government is now focusing on the enforcement of the Forestry Law, along with aspects of procedures, forest demarcation, elimination of illegal logging, and enlargement of natural forest conservations for eco-tourism. These actions will lead to the stabilization of the annual forest revenue stream received by the government at a level compatible with long-term sustainable forest resource management. Also, the government has been successful in achieving significant progress in forest concessions management to ensure the sustainable management of forest resources.

The government has also taken steps towards promoting conservation, including a check on logging activities. In order to improve the performance of forest concessionaires conducting commercial logging activities, the Royal Government of Cambodia has introduced several measures. These include the suspension of logging activities from January 2002 until such time that a concessionaire would have a new forest management plan approved by the MAFF, consistent with international standards. It would also require the negotiation of a model forest management investment

agreement with the government. Those companies that cannot fulfil these requirements will be subject to a termination of contract.

Gender in Agriculture and Supporting Systems

Women constitute the major part of the population (52 %) in Cambodia, and most are engaged in agriculture. Therefore, it is very important to ensure their participation for the enhancement of agricultural production and food availability. The Ministry of Agriculture, Forests and Fisheries has been successful in bringing out gender-oriented projects which have been fairly successful including the:

*National Rice Integrated Pest Management Project in which 44% of 4,137 farmers trained were women.

*Agriculture Quality Improvement Project gave special emphasis to the involvement of both men and women in the planning, implementation, evaluation and decision-making in the project;

*Cambodia-Australia Agricultural Extension Project, which increased the percentage of female extension workers to 18% in target districts, with special accommodation for the less educated women;

*Agriculture Productivity Improvement Project (APIP), where 41% of the participants in on and off-farm trials, farmer training and demonstrations were women. About 90% of the female staff received some training;

*Women in Irrigation, Nutrition and Health Project, which provided training to 239 farmers in homestead production, of which 78%, or 187, were women. About 80% of the women were trained in Integrated Pest Management (IPM) and vegetable growing, and 59% were represented in IPM rice cultivation.[128]

The most significant part of these projects was that at all levels there was gender training. Such dynamic projects, coupled with the target goals listed in the NPRS, demonstrates the commitment of the MAFF towards gender mainstreaming. MAFF has also been involved in several measures to be implemented by the government:

*A formal career track was to be established by the government which would begin with three years of employment at the district level for agricultural graduates who were accepted into the MAFF. Half of these were to be filled by women.

*To provide credit and extension services to farmers in four provinces, ensuring equal distribution of men and women in such groups. All were to be given gender training. The Ministry of Women's Affairs was to be a member of the secretariat and the Provincial Department of Women's Affairs (PDWA), where this programme was to be implemented, is part of the task force for agro-enterprise development and agro-enterprise support services to be established within Women in Development Centres.

The Ministry of Rural Development is giving an equal effort to introduce gender-oriented programmes. This is evident from the fact that the Village Development Councils under their jurisdiction are supposed to have 40% women as council members.

6.2.2 Food Access and Livelihood Policies

Apart from fighting poverty through various government programmes it is also necessary that employment opportunities are increased to meet the needs of the growing population. The industrial sector and the role of the private sector are important areas of consideration for employment generation. Ensuring adequate access to land and other natural resources is also vital to improve food access and overall food security.

[128]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2004.

[129] Council for Social Development "National Poverty Reduction Strategy 2003-2005" Kingdom of Cambodia 20th December 2002

Poverty Alleviation

Cambodia has been unable to fully achieve its Millennium Development Goals. In food security it seems to be lagging behind with around 36% of the population suffering from poverty and its related effects. Slow agricultural growth has exacerbated income inequality.[134]

The NPRS has outlined eight poverty reduction goals:

1. Improving rural livelihoods;
2. Maintaining macroeconomic stability;
3. Expanding job opportunities;
4. Improving capabilities;
5. Strengthening institutions and improving governance;
6. Reducing vulnerability and strengthening social inclusion;
7. Promoting gender equality; and
8. Focussing on population through maternal health, increased access to education and rural opportunities.

Poor governance and lack of progress in judicial reform are major factors contributing to the poverty situation of the country. The focus must be on improved governance to include: better public goods and services, decentralisation, reduction in land problems (inequality of land holdings, property rights), eliminating corruption and promoting private investment. Improvements in all the above-mentioned sectors at an accelerated pace can bring about a fast, much-needed alleviation of the poverty situation.

A key issue in poverty reduction is the strengthening of public financial accountability. The budget is the one vital instrument for poverty reduction through resource mobilisation and expenditure policy and management. Apparently, resources are not utilised efficiently. Wages paid are low; tax revenues are also low as there is no incentive to pay for poor facilities. Measures to be taken in the area of Public Financial Management (PFM) include:

A. Improve resource mobilisation to ensure aggregate fiscal sustainability;

B. Reduce fiduciary risk to public funds; and

C. Improve alignment of public expenditures with poverty reduction.

Expenditure on vital areas, such as health, education and other such pro-poor targeting programmes, can help improve the poverty situation. The area of civil service reform also requies progress.

Access to Land

Secure access to land for the poor in Cambodia's countryside will greatly contribute to reducing poverty and ensuring economic growth with equity. The Ministry of Land Management, Urban Planning and Construction (MLMUPC) was created to deal with the issues of land use and management.

The objectives of the Cambodian government are to promote sustainable economic and social development, to decentralise land management and to reduce poverty. The vision of land policy was expressed in the Interim Paper on Land Policy Framework ,which has three main aspects:

1. Land rights will be administered in a way which make property rights legally clear and secure;

2. Concessions for social purposes will be made to distribute the vacant land of the government to socially needy households; and

3. Land will be managed in an environmentally sustainable way, which provides the poor with the opportunities for secure access to natural resources, for secure access to housing, and for access to credit and investment.

The achievement of the objective of equitable land distribution is to be supported by a sub-decree on social land concessions. The land distribution programmes will distribute idle land in the domain of the State to households identified with priority needs for social land concessions. This programme includes schemes which are initiated both at local and national levels. This is to help the landless poor, victims of natural disasters by providing them with adequate resources.

Education

Recognising education as one of the top four priority sectors, the government has increased its budget for education, from 13.6% to 15.7%, in 2001, to 18.2% in 2002, and which is to rise further to around 20 % by 2005. The basic education budget is projected to roughly double, from around 180 billion Riels in 2001, to 337 billion Riels in 2005. The basic education budget will remain between 70-78% of total sectoral public spending.[135]

The Ministry of Education Youth and Sport (MoEYS) has formulated its Education Strategic Plan (ESP) 2001-2005 and an Education Sector Support Programme (ESSP) 2002-2006. The government has also prepared the Education for All (EFA) National Plan 2003-2015, published in June 2003 . The 'Education for All Plan' seeks to ensure equity for nine years of primary education. The aim is to create favourable conditions for the children from poor families to attend school. Expanding public academic institutions and providing scholarships to poor students create favourable conditions. In ESSP, 12 priority action programmes have been brought out with the aim of providing education to disadvantaged groups.

In 2001, the MoEYS established a gender working group to collaborate closely with donors and NGO partners. In order to make education accessible to girls, specific interventions were planned. These include increasing the number of schools in rural areas. The education ministry is planning to construct 285 lower secondary schools in remote rural areas, which will provide access to 44,000 young people per year, providing scholarships to poor girls and expanding 45 existing higher secondary schools to serve students from outlying areas etc.[136]

In 2001, the ESSP included two separate non-formal educational programmes—traditional non-formal education classes and a short-term re-entry programme aimed at ensuring education for dropouts. In addition, the Department of Non-Formal Education is planning to train teachers and monitor these two programmes to strengthen the capacity of the education system. The MoEYS has plans to expand vocational training in rural areas and offer adult literacy by establishing community-learning centres. However, budgetary allocations have been lacking.

Industries

Apart from the agricultural sector, the industrial sector is another major contributor for employment and income generation. The Cambodian population is finding more opportunities in the industrial sector, which offers them better livelihood prospects than the agricultural sector. It is therefore essential to look at government policies in the industrial sector.

The industrial development plans of the government consist of two goals: (i) the development of export-oriented industries, and (ii) the development of import-substitution production of selected consumer goods.[130]These goals are to be achieved by promoting labour-intensive industries, natural resource-based industries, small and medium enterprises, agro-industries, technology transfer, upgrading the quality of industrial products, establishing industrial zones, and developing the import-substituting production of selected consumer goods.

The promotion of labour-intensive industries is to be through focusing on the garment and textile sub-sector. Here readily available women labourers enhance cost competitiveness. The government has realised that increasing market share in a competitive international

[130]Council for Social Development "National Poverty Reduction Strategy 2003-2005" Kingdom of Cambodia 20th December 2002

environment requires the upgrading of product quality, as well as greater productivity through improvements in technology and management. To date, most of the garment sector operates on a cut, manufacture and tailor basis, with fabric and accessories (zippers, buttons, thread) being imported, and the purchase of local inputs limited to transportation and freight clearing services, utility-type services to run factories and the construction of factories.

The government intends to diversify the manufacturing export base by encouraging toy production, whether under license or through foreign direct investment, which is considered to be well suited to the country's relatively large endowment of low skilled labour. Assembling electronic products, where all parts and components are initially fully imported, is the second area that will be promoted by the government.

The promotion of natural resource-based industries will focus on identifying and exploiting opportunities in the processing of natural resources, including non-metallic mineral resources. The emphasis is on manufacturing, construction materials, timber, and fisheries. The development of animal and fish breeding may permit their supply as a raw material for reprocessing factories.

As far as the small-scale industry and handicraft production is concerned, the government intends to give priority to the promotion of traditional art and crafts for the tourist market in both rural and urban areas. However, in order to succeed, it will be necessary for these enterprises to ensure sustained product quality. In addition, because they do not have access to credit, other than from high-cost moneylenders, they will need to be provided micro-finance credit facilities. There is also considerable encouragement being given to the small-scale tobacco producers who can contribute to increasing the supply of raw materials to large manufacturers.

Granting concession land plots to both domestic and foreign companies on a long-term basis to encourage processing is the core of agro-industry development strategy. This would support the participation of local small landholders through contract growing. Strengthening the economic linkage between agriculture and industry within the context of sound environmental management is seen as essential to the creation of incomes and employment.

The creation of industrial zones is aimed at facilitating export development and creating employment by providing the high-quality infrastructure and utilities needed to encourage investment. These zones for industrial/export processing include suburban Phnom Penh and Sihanoukville, as well as other possible regions, such as Koh Kong, Battambang (near the Thai border), and Banteay Meanchey (the most populous province).

Finally, as regards import substitution of selected consumer goods, it will be undertaken only after a careful analysis of whether or not there is a genuine prospect of a proposed venture becoming internationally competitive.

The Private Sector

The government's Rectangular Strategy describes the private sector as the 'engine of growth' in Cambodia. It is dominated by the informal sector and consists of individual entrepreneurs, small and medium enterprises, as well as international companies active in Cambodia. These are mostly involved in either the tourism or garment industry. With the restoration of peace and normality, business activity has been on the increase since 1991.

The government intends to promote private sector development through selected and carefully designed industrial policies which are as follows:

I. Encouraging expansion of the SME sector, especially through the provision of medium-and long-term finance;

II. Improving the performance of state-owned enterprises through the provision of medium-and long-term finance;

III. Stemming the flow of illegally imported products,

IV. Reducing barriers to exports, such as export taxes and the inefficient provision of trade facilitation services (e.g. licensing);

V. Reducing barriers to the importation of business inputs;

VI. Providing infant-industry protection in carefully selected instances;

VII. Enhancing linkages between SMEs and large industries;

VIII. Promoting a national productivity centre that will assist small and medium-size firms to increase productivity and reduce production costs;

IX. Establishing a National Institute of Standards to ensure that product quality matches regional and international standards;

X. Establishing national mechanical testing that will establish the quality and other specifications of products;

XI. Establishing an industrial property rights bureau that would protect new products, designs and technologies from illegal copy;

XII. Promoting vocational training domestically and overseas;

XIII. Promoting the one village and one product movement, and

XIV. Upgrading the legal framework in the area of factory law, industrial zone law, patent and industrial design law, weights and measures and industrial safety.

A number of studies have identified various constraints to private sector growth. Red tape and corruption, poor physical infrastructure, high transportation costs and lack of respect of signed contracts were stated to be important obstacles to growth. A World Bank study identified the top four constraints as corruption; crime, theft and disorder; anti-competitiveness or informal practices; and regulatory policy uncertainty. Legal and judicial reform is also necessary if private investment is to be forthcoming. A strong legal framework and judiciary is imperative for creating a favourable investment climate.

To facilitate private sector development, three national sub-committees – SME development, private participation in infrastructure and trade facilitation – comprising Government agencies and representatives from the private sector have been created to oversee policy formulation and implementation in the private sector. [131]

In 1994, the Law on Investment was passed with the aim of streamlining the foreign investment regime and providing generous and competitive concessions for direct private sector investment. The Law on Investment also created the Council for the Development of Cambodia (CDC), a one-stop service organisation for investment in Cambodia. The Law on Investment provides similar treatment to foreign and domestic investors alike, with the exception of the issue of land ownership, as set forth in Cambodia's constitution. Even in this area, the regulations are generous, with foreign investors able to set up 100% foreign-owned investment projects, lease land for a period of up to 70 years with the possibility of renewal thereafter and employ skilled labour from overseas. Among the proposed areas of investment are rice production, fisheries, rubber, hotels and transportation.

Cambodia has obtained "Generalized System of Preferences (GSP)" and "Most Favoured Nation (MFN)" status from its major trading partners, including the European Union, the USA, Japan, Canada and Australia.[132]It is also a signatory to the ASEAN Free Trade Agreement, which calls for lowering of tariffs for the growth of trade. Cambodia is a member of World Trade Oganization.

[131]Asian Development Bank "Country Strategy and Program – Cambodia 2005-2009" Kingdom of Cambodia, February 2005.

[132] Investment Policy and Law http://www.aseanindia.net/asean/countryprofiles/cambodia/invest-law.htm

6.2.3 Health and Nutrition Policies

Health

Since 1996, health centres and district referral hospitals are the two important areas where Cambodia's Ministry of Health has tried to concentrate funding, with the objective of providing a Minimum Package of Activities (MPA) and a Complementary Package of Activities (CPA), and a strong focus on maternal and child care. As a result, 40% of the 48 provincial and district hospitals are currently able to provide CPA and 82% of 991 health centres are able to provide MPA, according to the 2002 budget.[139] The minimum package focuses on maternal care, child-care, nutrition, communicable disease control etc.

In addition to these health care centres and hospitals, special programmes in nutrition, immunization, birth spacing and respiratory infections are being administered by the National Centre for Maternal and Child Health. Training of staff of health centres and hospitals, and the coordination of the implementation of work in these areas, is monitored under the national programme.

The annual public expenditure in Cambodia in the health sector is low at only 1% of the GDP. The public expenditure amounted to US$24 per capita, and there is only a limited flow of funding from the national level to the districts and provinces (only 53% channelled to provincial level). This results in low salaries and dissatisfied staff, who take recourse to illegal means of earning more, which adversely affects the health sector.[140] In 2001, the government spent US$98.2 million on the health sector, out of which US$65.3 was in the form of external aid to Cambodia.

Nutrition

Nutrition is essential for a child's survival and development. Moreover, the development of human capital facilitates economic growth. Hence improving nutrition is an economic investment with direct and indirect returns. Community nutrition programmes form an essential part of these interventions to tackle hunger. Feeding the mother and child with a nutritious diet also becomes of utmost importance.

The Cambodian Nutrition Investment Plan (CNIP) is one such policy that proposes to invest $4.1 million in nutrition over a five-year period (2003-2007). It is structured to contribute to SEDP-II and NPRS. The CNIP 2003-2007 is also based on the National Nutrition Plan of Action (NNPA) of 1995-96. It is a nationwide plan, covering both rural and urban areas, and focussing mainly on women and children. The CNIP proposes to set up a reliable growth monitoring and promotion system focused on the most vulnerable children.The growth monitoring and nutritional assessment of children below two years of age with follow up for two to five years is already being implemented by communities with the support of health staff in selected communes.

The Objectives[138] of the Cambodia Nutrition Investment Plan

1. Incorporate nutrition considerations in the second national socio-economic development plan and poverty reduction strategy paper;

2. Reduce levels of Protein Energy Malnutrition (PEM) in children less than 5 years of age;

3. Virtually eliminate deficiencies of iodine and Vitamin-A over five years;

4. Reduce by 10% the current levels of anaemia in children under 5, children under 2, child bearing women and pregnant women;

5. Increase coverage of antenatal care so weight gained during pregnancy can be monitored, and increase by 20% the number of women gaining nine kg or more during gestation, as compared to estimated levels in 2000;

[133] World Bank and IMF for the Cambodia Consultative Group Meeting "Cambodia at the Crossroads" Phnom Penh, December 6-7, 2004

[134]Asian Development Bank "Country Strategy and Program – Cambodia 2005-2009" Kingdom of Cambodia, February 2005

[135]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2005

6. Reduce levels of low birth weight;

7. Reduce levels of malnutrition in women of reproductive age (measured by BMI-Body Mass Index); and

8. Triple the percentage of mothers giving colostrum and exclusively breast-feeding their infants for six months.

The CNIP 2003-2007 overall strategy, therefore, is a community-based approach emphasising actions at the commune and household level with supportive national-level approaches.

UNICEF, through the Seth Koma Program, has also provided support to nutrition interventions. The components of this programme address three main underlying determinants of nutritional status: household food security, care for children and women, health, water and hygiene. The training of provincial, district and commune development committee members has proven invaluable. WFP is also implementing two projects that support food security and nutrition: a Protracted Relief and Recovery Operation, "Assisting People in Crisis" and a Development Project, "Maternal and Child Health". The latter provides supplementary feeding to mothers and young children in food insecure areas. Similarly, various other nutrition programmes are being carried out by organisations, such as Health Net International, World Vision Cambodia, Care International and Helen Keller International. Local NGOs, such as Khana, Racha, etc. are also extensively involved in nutrition interventions.

[136]Ministry of Women's Affairs, UNIFEM, World Bank, ADB, UNDP & DFID/UK "A Fair Share for Women" Cambodia Gender Assessment, Phnom Penh, April 2005

[137]Vepa.S, Swana, "Halving Hunger by 2015: A Framework for Action in the Asia-Pacific Region" Commissioned paper by UN Task Force on Hunger, (Mimeograph) August 2004

RECOMMENDATIONS

Recommendations

An interesting twist in the recent history of Southeast Asia is that, while some countries like Thailand and Vietnam have been successful in taking advantage of the prosperity of the region, others like Cambodia have not. The former countries are notable in their success in attracting capital and investment to reduce poverty. Others countries, however, either could not find a way out of poverty or have reverted back to poverty, being unable to sustain growth.

A number of small countries have taken advantage of the favourable conditions in Southeast Asia for foreign capital investment. It is now the turn of Cambodia to seize the opportunity. However, unless capital investments extend to rural areas of Cambodia, and people are given the opportunity to gain adequate incomes, it will not be possible to achieve prosperity. Moreover, if one ignores rural problems, people will continue to suffer from hunger and poverty, as well as disruption to their lives, which ultimately may lead to discontentment or unrest. In the case of Cambodia, there is considerable potential to attract foreign capital to complement its abundant human and natural resources in order to improve food security and reduce poverty.

Improved food security requires priority attention to the following areas:

1. Creation of Basic Infrastructure

Rural infrastructure in terms of all weather roads, electricity, and communications needs to be improved as a prerequisite to enhancing livelihood access. It is not possible to promote production and enterprise diversification without basic infrastructure.

2. Natural Resource Management

Environmental protection laws need to be tightened and more should be done to ensure community involvement in the sustainable management of natural resources if over-exploitation is to be avoided. Regeneration of forests, improving the vegetative cover, and management of water resources are key to the success of natural resource management.

3. Production and Productivity Enhancement in Agriculture

It is possible to alleviate hunger in a predominantly agricultural society through enhanced agricultural productivity and production, supported by technology, inputs and markets. A diversification of production and enterprises are equally important in different parts of the country. For example, the analysis has shown that Kampong Speu, Prey Veng, Siemreap and Svay Rieng hold the most promising potential for improvements in rice production and productivity. Three of these provinces, with the exception of Kampong Speu, show widespread poverty, a moderate literacy rate and more than 25% of female-headed households. These four provinces accounted for about one million hectares of rice cultivation in 1998, and in 2004, they contributed nearly 29% towards the per capita annual net cereal production of the country. Provinces could be selected for "Integrated Area Development Projects." The strategy consists of providing technology, inputs, credit, and assured markets to farmers. These are essentially lowland rain-fed wet season rice cultivation areas. The Cambodian Rice Research Institute could be closely involved in such projects, along with the International Rice Research Institute. Support for the research could be obtained from donor countries. In these areas, a diversification of agriculture with higher value crops, such as vegetables and fruits, and integration with fisheries and livestock for higher profitability could also be promoted.

Evolving and popularising location-specific high yielding short duration rice varieties, and dissemination of an appropriate management technology, is the key to productivity enhancement. Ensuring availability of quality seed on time is equally important. Protective irrigation and water management are also essential for yield improvement in these provinces.

More fertile and less waterlogged areas can be diversified into other crops, such as pulses, oilseeds, vegetables, mushrooms, and horticultural crops. Floriculture is also a profitable option.

Wherever the soil is not fertile, and crop diversification is not possible, enterprise diversification into fisheries, aquaculture (prawn farming) and livestock, such as cattle, pigs, goats, and ducks should be made possible.

In the uplands, crop diversification may include tree crops, such as mango, citrus, jackfruit, guavas, etc. Enterprises such as bee-keeping and goat rearing are other options. Dairy production is another option for export. Social forestry for firewood also helps to meet the growing demand for firewood. It also helps to conserve forests.

4. Employment Generation

While non-farm employment is more renumerative than farm employment, it is only possible to shift people to non-farm occupations after levels of education improve.

At present, though a large percentage of the population is literate, functional literacy may still be lacking. While a large percentage has not yet completed primary education, secondary education and above would seem to offer the main opportuity to reduce poverty. Hence, the first step is to improve the quality of primary education.

Employment possibilities in the private sector would improve with education up to secondary education and above. This would open up opportunities for the provision of vocational training. Education and relevant training would help both self-employment and wage employment. Since wages are low in Cambodia, if people are skilled it is possible to attract foreign direct investment in the food processing and other industries, in addition to the garment industry.

However, to accelerate the process, it is important to assess the demand for skills. Labour shortages are likely to occur in Southeast Asia for certain jobs that are no longer seen as remunerative by other countries, and therefore could be passed on to Cambodia. However, there is a need to identify niche areas and develop human resources in that direction.

Once education becomes functional, opportunities unfold:

1. Promotion of self-employment in agricultural and allied activities and non-agricultural activities that require education, vocational training, credit infrastructure and market support;

2.An assessment of the demand for skills and relevant training for the educated to make them avail of opportunities for regular salaried employment;

3. Promotion of wage employment for illiterate and landless people in rural areas need to be integrated with basic infrastructure development and natural resource management, such as construction of roads, irrigation structures, and forest plantations. It is important to have a commune-level or district-level plan for the development of infrastructure and environmental restoration, along with labour requirements and a labour supply assessment. Wage employment needs to be well planned to provide supplementary employment to rural people in off-peak seasons;

4. Promotion of wage employment on commercial farms and plantations and food processing industries may also be expanded;

5. Non-farm employment opportunities are available at present mainly in the tourism and garment industries. This base should be further enlarged through the identification of other sectors. Private sector investment that promotes employment needs to be given special concessions; and

6. Salaried employment in the government sector is poorly remunerated. Efforts need to be made to increase their skills and capacities to take over the planning and effective implementation of government programmes. Their remuneration needs to be enhanced so that their dependence on other sources of income is considerably reduced.

5. Nutrition Security and Safety Nets to Fight Transient Hunger

Nutritional adequacy has to be ensured in the short run. Hungry people are highly vulnerable to natural disasters, such as floods and droughts, as well as man-made disasters, such as land mines and conflicts. Food

shortages during the lean months make the vulnerable reduce their food intake and lose their assets, thus making them incapable of taking any risky ventures for self-employment. The interest rates from moneylenders are also high, at around 100%, thus making borrowing and starting an enterprise highly risky.

Any advances in terms of crop intensification or enterprise diversification will also have to ensure nutritional security. Food-based safety nets are therefore a requirement for vulnerable populations in the provinces. Such safety nets can be provided through a variety of programmes linked to food transfers, food for work, food for training, etc. In addition, there should be a permanent safety net and disaster mitigation mechanism to help people when they need food. Effective community rice banks, food stamps for subsidised food purchases, or food distribution systems run by responsible NGO's and other organisations are various options to be considered.

A life cycle approach to the nutritional needs of the vulnerable should be adopted. The priority target groups in the population for safety nets are pre-school children, pregnant and lactating mothers, adolescent girls, school-going children and the diseased (TB/HIV-AIDS patients). The nutrition and food distribution programmes, along with health and growth monitoring, should involve the health centres. Nutritious and supplementary foods may be fortified with iron, iodine and other essential nutrients. School meal programmes are another way of helping school-going children and enhancing the nutrition of girls.

To fight hidden hunger it is important to adopt a two-pronged approach. The first is to spread nutrition knowledge and ensure people consume more fruits and vegetables from home gardens. Since most people have a back yard, home gardens of leafy vegetables and yellow vegetables with vitamins and iron should be encouraged. Community home gardens on which the vegetables are grown could be an alternative in the case of land and resource shortages. The second approach is to distribute fortified foods, such as blended foods in food supplementation programmes. Yet another option is to support the general fortification of foods with micronutrients. Above all, foods eaten by the poorer segments of the population need to be fortified.

APPENDICES

Appendix 1.1

Table 2.1 - Time Trend Equations for Food Crops, 1994-2004

No	Crop Name	Area Equation	Yield Equation	Production Equation
1	Total Cereals	Ln A (Total Cereals) = 14.36 + 0.025(t) (t = 3.73)	Ln Y (Total Cereals) = 9.68 + 0.028(t) (t = 4.66)	Ln P (Total Cereals) = 14.82 + 0.053(t) (t = 5.07)
2	Rice, Paddy	Ln A(Rice, Paddy) = 14.34 + 0.023(t) (t = 3.32)	Ln Y (Rice, Paddy) = 9.69 + 0.027(t) (t = 4.55)	Ln P (Rice, Paddy) = 14.82 + 0.050(t) (t = 4.66)
3	Maize	Ln A (Maize) = 10.36 + 0.093(t) (t = 6.35)	Ln Y (Maize) = 9.26 + 0.081(t) (t = 4.07)	Ln P (Maize) = 10.41 + 0.173(t) (t = 6.32)
4	Coarse Grain	Ln A (Coarse Grain) = 10.36 + 0.093(t) (t = 6.35)	Ln Y (Coarse Grain) = 9.26 + 0.081(t) (t = 4.07)	Ln P (Coarse Grain) = 10.41 + 0.173(t) (t = 6.32)
5	Total Pulses	Ln A (Total Pulses) = 9.99 + 0.037(t) (t = 1.97)	Ln A (Total Pulses) = 8.70 + 0.008(t) (t = 0.687)	Ln P (Total Pulses) = 9.48 + 0.045(t) (t = 1.81)
6	Sugarc-ane	Ln A (Sugarcane) = 8.78 + 0.035(t) (t = 4.53)	Ln Y (Sugarcane) = 12.50 + (-0.026)(t) (t = -2.31)	Ln P (Sugarcane) = 12.07 + 0.009(t) (t = 0.53)
7	Roots & Tubers	LN A (R & T) = 9.878 + 0.039 (t) (t = 3.362)	LN Y (R & T) = 10.995 + 0.019 (t) (t = 0.880)	LN P (R & T) = 11.663 + 0.058 (t) (t = 2.784)
8	Fresh Fruit	LN A (Fresh Fruit) = 8.872 + 0.030 (t) (t = 8.117)	LN Y (Fresh Fruit) = 11.112 + (-0.011) (t) (t = -4.405)	LN P (Fresh Fruit) = 10.774 + 0.019 (t) (t = 11.456)
9	Veg & Melons	LN A (Veg&M) = 11.132 + 0.010(t) (t = 4.123)	LN Y (Veg & M) = 11.120 + (-0.008) (t) (t = -4.218)	LN P (Veg & M) = 13.042 + 0.002 (t) (t = 1.214)

Source: Website: http://faostat.fao.org/faostat/collections?subset=agriculture

Appendix 1.2

Table 2.2 - Time Trend Equations for Non-Food Crops, 1994-2004

No	Crop Name	Area Equation	Yield Equation	Production Equation
1	Oilseeds Nes	-	-	LN P (Oilseeds Nes) =8.313 + 0.011 (t) (t = 18.581)
2	Fibre Crops Nes	-	-	LN P (Fibre Crops Nes)=7.685 + 0.023 (t) (t = 7.371)
3	Cotton Lint	LN A (Cot.Lint) = 5.636 + (- 0.009) (t) (t = -1.749)	LN Y (Cot.Lint) =8.108 + 0.0007 (t) (t = 3.349)	LN P (Cot.Lint) =4.534 + (-0.0009) (t) (t = -1.580)
4	Jute	LN A (Jute) =7.534 + (-0.184) (t) (t = -3.014)	LN Y (Jute) =8.967 + 0.055 (t) (t = 2.328)	LN P (Jute) =7.290 + (-0.129) (t) (t = -1.847)
5	Tobacco Leaves	Ln A (Tobacco) =9.60 + (-0.051) (t) (t = -3.43)	Ln Y (Tobacco) =9.03 + (-0.023) (t) (t = -1.75)	Ln P (Tobacco) =9.42 + (-0.074) (t) (t = -3.37)

Source: Website: http://faostat.fao.org/faostat/collections?subset=agriculture

Appendix 1.3

Table 2.3 - Time Trend Equations for Animal Production, 1994-2004

No	Products	Production Equation
1	Total Milk (Mt) *	Ln P (Total Milk) =9.83 + 0.016(t) (t = 9.45)
2	Total Eggs (Mt)	Ln P (Eggs Primary) =9.45 + 0.027(t) (t = 11.84)
3	Beef and Veal (Mt)	Ln P (Beef & Veal) =10.47 + 0.046(t) (t = 5.66)
4	Buffalo Meat (Mt)	Ln P (Buffalo Meat) = 9.24 + 0.002(t) (t = 0.12)
5	Pig Meat (Mt)	Ln P (Pig Meat) =11.32 + 0.027(t) (t = 4.88)
6	Chicken Meat (Mt)	Ln P (Chicken Meat) 9.72 + 0.008(t) (t = 0.74)
7	Duck Meat (Mt)	Ln P (Duck Meat) =8.34 + 0.063(t) (t = 16.36)
8	Total Meats (Mt)	Ln P (Total Meat) =11.91 + 0.030(t) (t = 6.84)

Source: Website: http://faostat.fao.org/faostat/collections?subset=agriculture
Note: * Analysis made for six years data only. Data are not available from 2000 to 2004.

Appendix 2.1

Data for some years was not available for crops

1. **Rice:** Kep - Data for the following two years 1993 & 1994 was not available.

2. **Maize:** Koh Kong - 1999 data was not available, Kep - 1993, 1994 & 1999 data was not available, Sihanoukville - 1994 & 1997 data was not available, Mondul Kiri - 1993 data was not available.

3. **Mungbean:** Kampong Thom - 1998 data was not available, Mondul Kiri - 1993, 1998 & 1999 data was not available, Preah Vihear - 1995, 1996 & 1999 data was not available, Ratanak Kiri - 1993, 1995, 1998 & 1999 data was not available, Svay Rieng - 1993, 1994, 1997 & 1999 was not available.

4. **Cassava:** Koh Kong - 1999 data was not available, Kep - 1993 & 1994 data was not available, Sihanoukville - 1993 data was not available, Mondul Kiri - 1993 data was not available, Phnom Penh - 1997 data was not available, Preah Vihear - 1993 data was not available, Ratanak Kiri- 1995 data was not available.

5. **Potato:** Koh Kong - 1999 data was not available, Kep - 1993 & 1994 was not available, Mondul Kiri – 1993 was not available, Phnom Penh - 1994, 1995, 1997, 1998 & 2001 data was not available, Ratanak Kiri - 1995 data was not available.

6.**Soybean:** Battambang - 1993 data was not available, Kampong Cham - 1993 data was not available, Kampong Thom - 1993 & 2000 data was not available, Kandal - 1993-1997 & 2000 data was not available, Kratie - 1993, 1994, 1995 & 2000 data was not available, Mondul Kiri - 1993, 1994, 1997, 1998, 1999 & 2001 data was not available, Ratanak Kiri - 1993, 1995, 1996 data was not available.

7. **Peanut:** Kep: 1993-1995 & 1999 data was not available, Mondul Kiri – 1994, 1995 & 1997-2000 data was not available, Preah Vihear - 1995 & 1996 data was not available, Ratanak Kiri & 1993 & 1995 data was not available, Stung Treng - 1995 data was not available, Takeo - 1998 data was not available.

8. **Sesame:** Banteay Meanchey - 1993 & 2001 data was not available, Battambang - 1993 data was not available, Kampong Cham - 1998, 2000 & 2001 data was not available, Kampong Speu - 1998, 2000 & 2001 data was not available, Kampong Thom - 1996 data was not available, Phnom Penh - 1998 & 2002 data was not available, Preah Vihear - 1995 & 1996 data was not available, Ratanak Kiri - 1995 data was not available, Stung Treng - 1996 data was not available, Takeo - 2001-2003 data was not available.

9. **Sugarcane:** Sihanoukville - 1993 & 2000 data was not available, Mondul Kiri - 1993 data was not available, Preah Vihear - 1993, 1995 & 1996 was not available, Ratanak Kiri - 1993, 1995 & 2002 data was not available.

10. **Vegetables:** Koh Kong - 1999 data was not available, Kep - 1993 & 1994 data was not available, Sihanoukville - 1993 data was not available, Mondul Kiri - 1993 data was not available, Ratanak Kiri - 1995 data was not available.

11. **Jute:** Banteay Meanchey - 2001 data was not available, Kampong Thom - 1997, 1999 & 2000-2002 data was not available, Kandal - 1998 data was not available.

12. **Tobacco:** Stung Treng - 1993 & 2001 data was not available.

Appendix 3. 1
Poverty lines for Cambodia[1]

The poverty line gives us the consumption/income level that separates the poor from the rest of the population. Consumption is the preferred denominator since income values tend to be understated and discrepancies are often observed between declared income and declared consumption. Besides, data on consumption is better recorded and is available in CSES 1993/93, 1997 and 1999 and CSES 2004. Consumption is divided into two categories - food consumption and non-food consumption. The poorer the people are, the higher the proportion of consumption devoted to food. Therefore, in determining consumption levels that can be used to separate the poor from the not so poor, food consumption is the most significant measure. Thus, a food poverty line is calculated and the non-food minimum allowance is calculated and added to this, to get the total poverty line.

Food Poverty Line: In Cambodia, the benchmark level of nutrition for basic subsistence adopted is 2,100 calories minimum energy requirement per person per day. This is very low given that according to the World Health Organization, the daily calorie requirement for a subsistence farmer (a large part of the Cambodian population) is 2,780 calories. The population group chosen to derive the model composition of food consumption is the third quintile for total consumption distribution. The reference food basket obtained contains 69% cereals, especially rice, and has a calorie content of 2,100. The cost of this basket is then determined using market prices. A food poverty line is calculated for urban, rural and Phnom Penh regions.

Non-food Poverty Line: For those individuals who are exactly on the food poverty line, the welfare received from their expenditure on non-food items will be higher than the welfare from equivalent food expenditure that they forgo. Therefore, their non-food expenditure can be considered as a minimum allowance for non-food spending. However, the value of non-food items is not recorded in any of the CSES surveys. Hence, a slightly roundabout approach is used to calculate the non-food poverty line. A food demand function for each strata (urban, rural and Phnom Penh) is computed.

It is given by $S_i^j = \alpha_j + \beta \log(x_i / z_j^f)$

where

S_i^j - gives the food share for household i in strata j

x_i - gives the total spending for household i

z_j^f - gives the food poverty line for strata j

These three variables are known and hence α_j and β can be estimated for each stratum. For those households exactly on the food poverty line $x_i = z_j^f$, the log will be zero.

Thus the food share for those just reaching the food poverty line is α_j. The non-food share for each stratum is (1- α_j) and thus the non-food allowance is $z_j^f(1-\alpha_j)$. Adding the non-food allowance to the food poverty line for each stratum captures the overall food poverty line. Then the overall poverty line is

$$z_j = z_j^f + z_j^f(1-\alpha_j) = z_j^f(2-\alpha_j)$$

Therefore, we can calculate a poverty line for each of the three strata. The three aspects to be incorporated while studying poverty are the number of poor people, the extent or intensity of poverty and, finally, the inequality in poverty. The FGT (Foster, Greer and Thorbecke, 1984) measure captures all the three aspects using the following formula.

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-x_i}{z}\right)^\alpha$$

Where, x_i - the average real spending of the household member is *i* (here per capita expenditure for person *i*); the poverty line is z; the number of people in the sample population is *n*; the number of poor people (all household members in adult equivalents below the poverty line) is *q*; and the measure of inequality aversion or coefficient relating different degrees of importance is α.

Appendix 3.2 - Factors influencing poverty at the province level

Please note that the value in brackets is the standard error. The following abbreviations are used for the variables:

Poverty = Poverty rate

Totlit = Total literacy rate

Unemp = Unemployment rate

Femlit = Female literacy rate

Prime Edu =people with primary education

Access Elec = access to electricity

Pc deficit = per capita deficit

Rice Insta = rice yield instability

The following equations were estimated for 24 provinces.

1) Poverty = 13.79+0.30totlit-0.79unemp + 0.053 pc deficit

(0.259) (1.20) (0.03)

2) Poverty = 4 2.56 +0.47totlit-2.02prime Edu + 0.033 pc deficit

(0.241) (0.911) (0.028)

3) Poverty = 47.67+ 0.412 femlit - 1.87 prime Edu + 0.0360 pc deficit

(.225) (.898) (.028)

4) Poverty = 63.55+ 0.662 femlit - 2.79 prime edu- 0.041pc deficit - 1.31unemp

(.333) (1.31) (0.033) (1.60)

It was found that the percentage with primary education is significant in equation (3). The 'R' square was significant at 5% level for this equation. Primary education helps to reduce poverty at the province level. The coefficient for primary education was found to be significant in equation 4. However, for this equation, though the R square value was low, the F value was also not seen to be significant at 1% and at the 5% level of significance.

Appendix 3.3

Household Distribution Based on Actively Seeking Employment Categorization

No	Category	No. of Sample Households	Valid %
1	Yes	48	4.37
2	No	1051	95.63
3	Total	1099	100.00
	Missing System	7901	87.76
	Grand Total	9000	100.00

Source: Computed from CSES 2004 database.

[1]Royal Government of Cambodia, Ministry of Planning and UNDP, "Estimation of Poverty Rates at Commune Level in Cambodia", October 2002.

Appendix 3.4

Per Capita Daily Cereal Consumption (Riels)													
No	Province	Riels	Nil	Upto 100	100 to 500	500 to 1000	1000 to 2000	2000 to 4000	4000 to 10000	10000 to 20000	Total	Missing System	Grand Total
1	Banteay Meanchey	No. of Sample HH	--	12	372	79	10	6	1	--	480	--	--
		Valid Percent	--	2.50	77.50	16.46	2.08	1.25	0.21	--	100	--	--
2	Battambang	No. of Sample HH	18	18	512	84	30	4	1	--	667	--	--
		Valid Percent	2.70	2.70	76.76	12.59	4.50	0.60	0.15	--	100	--	--
3	Kampong Cham	No. of Sample HH	17	23	977	146	29	7	1	--	1200	--	--
		Valid Percent	1.42	1.92	81.42	12.17	2.42	0.58	0.08	--	100	--	--
4	Kampong Chhnang	No. of Sample HH	2	12	237	52	5	2	--	--	310	--	--
		Valid Percent	0.65	3.87	76.45	16.77	1.61	0.65	--	--	100	--	--
5	Kampong Speu	No. of Sample HH	11	8	410	41	5	4	--	--	479	--	--
		Valid Percent	2.30	1.67	85.59	8.56	1.04	0.84	--	--	100	--	--
6	Kampong Thom	No. of Sample HH	--	6	390	47	11	6	--	--	460	--	--
		Valid Percent	--	1.30	84.78	10.22	2.39	1.30	--	--	100	--	--
7	Kampot	No. of Sample HH	7	9	301	81	11	--	8	1	418	--	--
		Valid Percent	1.67	2.15	72.01	19.38	2.63	--	1.91	0.24	100	--	--
8	Kandal	No. of Sample HH	33	52	441	170	61	16	2	--	775	4	779
		Valid Percent	4.26	6.71	56.90	21.94	7.87	2.06	0.26	--	100	0.51	100
9	Koh Kong	No. of Sample HH	--	1	73	6	--	--	--	--	80	--	--
		Valid Percent	--	1.25	91.25	7.50	--	--	--	--	100	--	--
10	Kratie	No. of Sample HH	1	--	--	--	241	32	--	5	279	--	--
		Valid Percent	0.36	--	--	--	86.38	11.47	--	1.79	100	--	--
11	Kep	No. of Sample HH	--	--	30	--	--	--	--	--	--	--	--
		Valid Percent	--	--	100	--	--	--	--	--	--	--	--
12	Pailin	No. of Sample HH	--	1	33	6	--	--	--	--	40	--	--
		Valid Percent	--	2.50	82.50	15.00	--	--	--	--	100	--	--
13	Sihanoukville	No. of Sample HH	1	--	51	16	2	--	--	--	70	--	--
		Valid Percent	1.43	--	72.86	22.86	2.86	--	--	--	100	--	--
14	Mondul Kiri	No. of Sample HH	--	--	15	12	2	--	1	--	30	--	--
		Valid Percent	--	--	50.00	40.00	6.67	--	3.33	--	100	--	--
15	Oddar Meanchey	No. of Sample HH	--	--	17	3	--	--	--	--	20	--	--
		Valid Percent	--	--	85.00	15.00	--	--	--	--	100	--	--
16	Phnom Penh	No. of Sample HH	23	32	557	146	57	18	1	1	835	--	--
		Valid Percent	2.75	3.83	66.71	17.49	6.83	2.16	0.12	0.12	100	--	--
17	Pursat	No. of Sample HH	1	10	236	26	6	1	--	--	280	--	--
		Valid Percent	0.36	3.57	84.29	9.29	2.14	0.36	--	--	100	--	--
18	Preah Vihear	No. of Sample HH	8	1	66	23	2	--	--	--	100	--	--
		Valid Percent	8.00	1.00	66.00	23.00	2.00	--	--	--	100	--	--
19	Prey Veng	No. of Sample HH	1	14	550	84	6	4	--	-	659	-	-
		Valid Percent	0.2	2.10	83.50	12.70	0.90	0.60	--	--	100	--	--
20	Ratanak Kiri	No. of Sample HH	--	1	55	23	5	6	--	--	90	--	--
		Valid Percent	--	1.11	61.11	25.56	5.56	6.67	--	--	100	--	--
21	Siemreap	No. of Sample HH	2	18	436	119	8	5	2	--	590	--	--
		Valid Percent	0.34	3.05	73.90	20.17	1.36	0.85	0.34	--	100	--	--
22	Stung Treng	No. of Sample HH	--	4	64	12	--	--	--	--	80	--	--
		Valid Percent	--	5.00	80.00	15.00	--	--	--	--	100	--	--
23	Svay Rieng	No. of Sample HH	5	13	284	68	8	1	1	--	380	--	--
		Valid Percent	1.32	3.42	74.74	17.89	2.11	0.26	0.26	--	100	--	--
24	Takeo	No. of Sample HH	11	21	430	135	28	4	1	--	630	--	--
		Valid Percent	1.75	3.33	68.25	21.43	4.44	0.63	0.16	--	100	--	--

Source: Computed from 9000 sample households of CSES 2004 database.

Appendix 3.5

Literate and Illiterate Population by Province							
No.	Province	Literate		Illiterate		Total	
1	Banteay Meanchey	323	67.29	157	32.71	480	100
2	Battambang	496	74.36	171	25.64	667	100
3	Kampong Cham	771	64.41	429	35.59	1200	100
4	Kampong Chhnang	189	60.97	121	39.03	310	100
5	Kampong Speu	291	60.75	188	39.25	479	100
6	Kampong Thom	287	65.39	173	37.61	460	100
7	Kampot	268	64.11	150	35.89	418	100
8	Kandal	584	74.97	195	25.03	779	100
9	Koh Kong	48	60.00	32	40.00	80	100
10	Kratie	202	72.40	77	27.60	279	100
11	Kep	15	50.00	15	50.00	30	100
12	Pailin	29	72.500	11	27.500	40	100
13	Sihanoukville	40	57.14	30	42.86	70	100
14	Mondul Kiri	5	16.67	25	83.33	30	100
15	Oddar Meanchey	3	15.00	17	85.00	20	100
16	Phnom Penh	733	87.78	102	12.22	835	100
17	Pursat	207	73.84	74	26.16	280	100
18	Preah Vihear	44	44.00	56	56.00	100	100
19	Prey Veng	406	61.61	253	38.39	659	100
20	Ratanak Kiri	38	42.22	52	57.78	90	100
21	Siemreap	324	54.92	266	45.08	590	100
22	Stung Treng	49	61.25	31	38.75	80	100
23	Svay Rieng	236	62.11	144	37.89	380	100
24	Takeo	431	68.41	199	31.59	630	100

Source: Computed from CSES 2004 database.
Note: Figures in bold are sample households.

Appendix 3.6 - Factors influencing poverty at household level (based on CSES 2004)

The household level factors that influence poverty have been adequately recognised by the following models:

Model 1

Value of consumption of various occupational categories:

Y = 1357.82 + 1.5 X – 616.33 Dl – 543.23 Ds – 287.81 Dm

(63.93)* (-8.30)* (-19.87)* (-1.13)

where, Y = Per capita per day value of food consumption

X = Per capita per day value of cereal consumption

Dl = 1 if respondent is labourer, 0 otherwise

Ds = 1 if respondent is subsistence farmer, 0 otherwise

Dm= 1 if respondent markets crops produced, 0 otherwise

The model fit is reasonably good, with a R square value explaining 37% of the variations in the value of food consumed. The F-statistics is significant.

The base category consists of occupations other than labour, subsistence farmer and farmer with market surplus. They belong to occupations such as livestock rearing, fisheries, or as a government employee. The average per capita consumption of this category is given by 1357.82 + 1.5 X. It can be seen that those employed in this 'other' occupations are better off in terms of per capita consumption. Since the t-statistic for the dummy for market producers is not significant, we can conclude that those producing for the market and those employed in other occupations do not have much difference in their per capita consumption.

For those individuals employed as labourers, the per capita consumption is below the per capita consumption of those employed in other occupations by almost 616 units. For the subsistence farmers, per capita consumption deviates from that of the base category by almost 543 units. In summary, the results of our analysis are as follows. Individuals who are employed in livestock, fisheries, etc. have higher levels of consumption and, therefore, probably a greater calorie intake. Those who market their produce also have a high level of consumption. But those who are dependent entirely on land – labourers and subsistence farmers – have comparatively lower levels of consumption. Their consumption levels are 616 and 543 units (Riels) less than that of the base category. This has important implications for government policy. Policies aimed at improving nutrition and consumption levels should perhaps be specifically targeted towards agricultural labour and subsistence farmers.

Model 2

The impact of literacy on per capita consumption:

It is given by:

Y = 814.31 + 1.50X + 443.74D

(31.07)* (63.67)* (15.40)*

where Y = Per capita per day consumption

X = Per capita per day cereal consumption

D = 1 if literate, 0 otherwise

This model has a good fit with an R square explaining 36% of variations in the dependent variable. It has a significant F- statistics value.

The average per capita consumption of an illiterate person is given by 814.31 + 1.50X. The positive sign for the dummy variable suggests that being literate has a positive bearing and adds to the per capita consumption. Literacy translates into better and more employment opportunities, and this increases the incomes and therefore consumption levels. Since the t-statistic for the dummy variable is significant, we can conclude that being literate significantly increases per capita consumption.

Model 3

Impact of household size on value of food consumption:

Y = 2614.09 – 162.62 HH (-22.12)* where

Y = Per capita per day consumption

HH = Household size

The R square value is significant, indicating that the model has a good fit. The larger the size of the household, the smaller is the per day consumption of each member of the household. This relation is positive and significant, as expected, seen from the t value of the coefficient. In order to better understand how factors such as education, head of the household and the occupational structure determine the size of a household some simple linear regressions were run.

Model 4

Household size and literacy:

HH = 4.846 + .374D (7.633)*

where

HH = Household size

D = 1 if literate, 0 otherwise.

The average size of a household where the respondent is illiterate is 4.85. The household size is higher by .374 when the respondent is literate. Being literate means more and better paying job opportunities. This increases the overall security and stability of the household. Also, literate households may have reduced infant mortality rates because of better awareness and access to better hospital facilities. This may have a positive impact on the number of children in the household and a bigger household.

Model 5

Household size and the occupational category:

HH = 5.04 – .357Dl + .196Ds + .486Dm

(-2.79)* (4.152)* (1.114)

where

Dl = 1 if labourer, 0 otherwise

Ds = 1 if subsistence farmer, 0 otherwise

Dm = 1 if marketing produce, 0 otherwise

Both the R square and the coefficients in the equation are significant.

The above regression gives us some interesting results. The average size of households for those in the 'others' category is 5.04. Since the t-statistic for the dummy for marketed produce is not significant, we can infer that the household size of this category and the 'others' category does not differ much. However, subsistence farmers have comparatively larger households than the 'other' category, whereas the households of labourers are actually smaller by .357.

Therefore, we can conclude that on average, the subsistence farmer has the largest household size and the labour households have smaller households. The farmer who markets his produce and those employed in other activities like livestock rearing, fishing, etc. have smaller household size than the farmer and a larger one than the labour households. The farmers who produce for their subsistence have the larger families, perhaps in order to have more hands to work in the field.

Model 6

Household size and female-headed households:

HH = 5.19 - .44Dw

(-7.66)*

Where,

Dw = 1 if female headed, 0 otherwise.

It can be seen that those households headed by women are of a smaller size. Often it is the case that in female-headed households, the man of the house is deceased or a migrant worker. Elderly dependents are also fewer as the female-headed households tend to be very poor. This was one of the reasons for allocating less land to the female-headed households.

Model 7

Impact of female-headed household on cereal consumption:

Some additional regressions were run to see how the value of cereal consumption is affected by education, sex of the head of the household and occupational structure. It was found that cereal consumption is unaffected by literacy rate and occupational structure. However, the head of the household being male or female seemed to have an impact on the per capita value of cereal consumption of the household.

CEC = 431.97 + 63Dw (3.878)*

where

CEC = Per capita per day cereal consumption

Dw = 1 if female-headed household, 0 otherwise.

This model gives a good fit to the data with significant F-statistics for the R square value. It is seen that when a woman heads the household, the average per capita cereal consumption is higher by almost 63 units. Perhaps this could be because in the absence of a man, there is smaller or no expenditure on alcohol, tobacco and wasteful consumption. This is a very interesting finding.

Appendix 4.1 - Household-level analysis of the demographic health survey

The following models have been estimated:

Model 1

Y = 4.884 – 0.24 X1i + 0.93X2i + .012X3i –.027 X4i + .037D1i – .139D2i – .049D3i + .056D4i – .006D5i – .178D6i

where,

Y = weight/age scores scaled

X1 = Number of children 5 and under

X2 = Total children ever born

X3 = Current age of the mother

X4 = Number of eligible women in the household

D1 = 1 if child is first born, 0 otherwise

D2 = 1 if size of child is above average, 0 otherwise

D3 = 1 if size of child is average, 0 otherwise

D4 = 1 if size of child is below average, 0 otherwise

D5 = 1 if child has never been breast-fed, 0 otherwise

D6 = 1 if child is still breast-feeding, 0 otherwise

Model 1 includes basic demographic characteristics related to the child as well as some maternal characteristics. At the 1% and 5% level of significance, only three explanatory variables appear to be significant. These are: total children ever born, dummy for children weighing above average and dummy for the duration of breast-feeding (still breast-feeding). The total number of children ever born to the mother is associated positively with the underweight status of the child. This is a logical result due to two reasons. First, the more the number of children born, the greater the competition for the family resources and the lower the per capita resources available. Second, a mother with more children born, whether deceased or alive now, will have lower health status and hence more underweight children.

The data on birth weight was not available and hence the size of the baby has been used as a proxy for birth weight. The regression results tell us that a larger than average baby is negatively correlated with underweight status. This is in keeping with what we would intuitively expect.

Children who are still being breast-fed are seen to have a negative correlation with underweight status. This means that children who are still being breast-fed are significantly better off in terms of nutritional status and will tend to have a healthy weight for their age. At the 10% level of significance, the additional significant variables are the number of children below the age of 5, the number of eligible women, the order of birth dummy and the dummy for child weighing below average.

The number of eligible women is negatively correlated with the underweight status. This could be

because more women in the household mean that there are more income earners. Also, there are more people to attend to the needs of the child. It turns out that being a first-born child actually has a negative impact on the underweight status. It can be seen that a child weighing below average will be worse off in terms of its underweight status. The above model explains only 6% of the variance in the dependent variable. However, the R square is significant .

Model 2

In Model 2, the explanatory variables are the various health indicators. The purpose of this model is to see how the underweight status of a child is influenced by his/her health status. The immunisation index is calculated using data on whether the child has received BCG, DPT 1,2 &3, POLIO 1,2&3 and MEASLES vaccinations. The higher the value of the immunisation index, the higher the number of immunisation vaccinations the child has taken and therefore the better off the child is. However, in our analysis, this index turns out be an insignificant factor in explaining underweight status. The morbidity index is calculated based on the qualitative data: whether the child had fever in the last two weeks, had diarrhoea recently and had a cough in the last two weeks. The higher the value of the index, the less the child has fallen sick in the recent past and therefore the less morbid the child. This index is significant at the 1% level and is negatively correlated. This shows that the less morbid the child, the less underweight he/she will be.

It must be pointed out that the model discussed has a fit of less than 1%. However, the test of good fit does turn out to be significant, meaning that statistically the model has a good fit.

Y = 4.79 + .007X1i - .017X2i + .098D3i

where,

Y = weight/age Z- scores scaled

X1 = Index of immunisation

X2 = Index of morbidity

D1 = 1 if child is fully vaccinated and 0 otherwise.

Model 3

Y = 4.6 -.023D1i + .024D2i - .051D3i + .054D4i

where,

Y = weight/age z- scores scaled

D1 = 1 if source of drinking water is surface water, 0 otherwise

D2 = 1 if source of drinking water is well water, 0 otherwise

D3 = 1 if type of toilet facility is a flush, 0 otherwise

D4 = 1 if no toilet facilities exist, 0 otherwise

Model 3 includes the water and sanitation variables. A house with a toilet facility will have better sanitary conditions and hence the child will have a better health status. Not having any toilet facilities has an adverse impact on the child's underweight status. This model has a fit of .9%. The source of drinking water turns out to have an insignificant impact on child's underweight status.

Model 4

Y = 4.81 -.031D1i -.064D2i + .016D3i +. 001D4i - .056D5i where,

Y = weight/age scores scaled

D1 = 1 if mother has primary education, 0 otherwise

D2 = 1 if mother has post-primary education, 0 otherwise

D3 = 1 if partner has no education, 0 otherwise

D4 = 1 if partner has primary education, 0 otherwise

D5 = 1 if partner has post-primary education, 0 otherwise

We find that the indicator for primary education has an insignificant impact on the well being of the child. This is an interesting result. However, when the mother has attained post-primary education, her children are significantly better off in their underweight status. This implies that if the mother has attained primary education the child may stand the same chance of being underweight as the child of an uneducated mother. This may be due

to poor quality of education at the primary level. However, when the mother has also attained post-primary education, this indirectly improves the well being of the child. Higher education implies a higher earning capacity, increased awareness about childcare and hence greater possibility for a healthier child. The partner's education level does not have any impact on the underweight scores of the child. The model accounts for 1% of the variation in the outcome variable.

Model 5

Y = 4.66 + .046X1i - .032D1i - .05D2i - .021D3i + .027D4i - .003D5i - .008D6i - .020D7i - .016D8i

where,

Y = weight/age scores scaled

X1 = Number of household members

D1 = 1 if household has electricity, 0 otherwise

D2 = 1 if household has a television, 0 otherwise

D3 = 1 if mother is not working, 0 otherwise

D4 = 1 if mother is an unskilled manual worker, 0 otherwise

D5 = 1 if mother is a skilled manual worker, 0 otherwise

D6 = 1 if partner has no occupation, 0 otherwise

D7 = 1 if partner is an unskilled manual worker, 0 otherwise

D8 = 1 if partner is skilled manual worker, 0 otherwise

Model 5 includes household size and some indicators of poverty. The number of household members correlates positively with the underweight status of the child. One explanation for this is that more members imply more children and this could lead to malnourishment depending on how many children there are in the household and how impoverished, in general, the family is. There is good reason to believe that poorer households will be characterised by more members. Children are viewed as an extra source of income or a pair of extra helping hands, but not as an extra mouth to feed. In such a case, there is a tendency for a child born into such circumstances to be underweight and underfed. As expected, children living in a household with electricity and television sets are less likely to be underweight. This is so at the 10% level of significance for electricity and 1% level of significance in the case of ownership of television. Interestingly, the mother's occupation as well as the partner's occupation has no effect on the child's underweight status.

Model 6

Y = 4.52 + .036X1 + .076D1i + .022D2i

where,

Y = weight/age scores scaled

X1 = Number of household members

D1 = 1 if mother is employed in the agriculture sector, 0 if mother is employed in other sectors, i.e., services, clerical, managerial or armed forces

D2 = 1 if mother is employed as a manual labourer, 0 if mother is employed in other sectors, i.e. services, clerical, managerial or armed forces

The purpose of this Model 6 is to see how the underweight status of the child differs for mothers employed in different sectors. The reference category is the mothers employed in services: mainly technical, managerial, clerical and armed forces. It is seen that children whose mothers are employed as labourers are not significantly different in terms of their underweight status from the children whose mothers are employed in the reference group. However, when the mother is employed in the agricultural sector, her children stand a high chance of being underweight.

Concluding remarks

This study attempted to capture the various determinants of underweight children at the micro-level in Cambodia. The best-fitting model explained 6% of the variations in the dependent variable. This is a good fit considering that most of the variables were qualitative in nature. The R square value was significant.

Appendix 5.1

Availability Indicators									
N-o		Province / Municipality	Total Irrigated Area	Rice Production (2003)	Per Capita Deficit of Rice Prod. over Consumption (1998)	% of Forest to TGA of Province	% of Agricultural Land to TGA of	% of Area under Plantation	% of Area under Water Bodies
1	p	Banteay Meanchey	35576	323163	142.93	35.98	35.67	6.38	0.59
2	p	Battambang	59292	446359	135.62	51.04	20.51	4.38	0.36
3	p	Kampong Cham	85277	484551	-34.24	27.78	42.65	10.28	3.15
4	p	Kampong Chhnang	48940	186336	56.22	47.73	18.03	5.38	3.25
5	p	Kampong Speu	23845	181154	-56.51	60.60	30.91	7.23	0.18
6	p	Kampong Thom	77162	169012	61.43	46.48	31.12	2.80	1.00
7	p	Kampot	69707	285966	81.89	52.11	39.61	6.08	0.47
8	p	Kandal	68927	304376	-160.80	0.00	45.46	1.24	16.9
9	p	Koh Kong	5307	12527	-166.32	86.04	1.57	2.60	0.00
10	p	Kratie	9235	95334	-108.99	86.71	4.82	2.08	2.68
11	m	Kep	3786	7390	-207.68	12.56	68.10	8.83	0.01
12	m	Pailin	520	1274	-224.00	98.69	0.00	1.31	13.44
13	m	Sihanoukville	15530	28376	-140.20	72.24	18.79	3.03	0.00
14	p	Mondul Kiri	3001	19260	-89.98	94.01	0.30	1.40	2.75
15	p	Oddar Meanchey	48364	59382	-223.40	81.05	12.04	4.50	0.33
16	m	Phnom Penh	6328	21571	-212.55	0.00	55.35	0.00	0.00
17	p	Pursat	25435	135678	69.36	71.96	12.17	4.68	0.66
18	p	Preah Vihear	30366	40906	-94.47	90.17	2.86	5.34	0.19
19	p	Prey Veng	71221	639452	11.43	0.30	65.52	0.58	1.90
20	p	Ratanak Kiri	6997	47052	-45.10	82.42	12.54	1.71	0.27
21	p	Siemreap	122203	256795	55.85	47.53	35.64	1.49	4.30
22	p	Stung Treng	5693	33950	-26.99	93.58	2.45	1.89	0.08
23	p	Svay Rieng	102256	314336	52.02	1.38	79.25	0.00	0.00
24	p	Takeo	121295	616757	78.09	0.33	74.03	6.08	0.00
		Cambodia	1046263	4300000	31.43	62.57	20.37	3.61	2.65

Source: Col. 1, Ministry of Water Resources and Meteorology, Planning and International Co-operation Department; Col. 2 & 3 http://www.faorap-apcas.org/cambodia/busdirectory/search_results.asp; Col. 4-7, International Rice Research Institute (IRRI).

Appendix 5.2

Correlation of Availability Indicators								
		1	2	3	4	5	6	7
1	Total Irrigated Area	1	0.775**	0.600**	-0.581	0.596**	0.094	0.054
2	Rice Production		1	0.661**	-0.647	0.616**	0.204	0.023
3	Per Capita Deficit of Production Over Consumption			1	-0241	0.252	0.153	-0.031
4	% of Forest to TGA of Province				1	-0.946**	-0.075	-0.062
5	% of Agricultural Land (upland and paddy) to TGA of Province					1	0.117	-0.081
6	% of Plantation to TGA of Province						1	-0.263
7	% of Water Bodies to TGA of Provine							1
** Correlation is significant at the 0.01 level (2-tailed)1								

Appendix 5.3

Food Access Indicators

N-0.		Province/ Municipality	Poverty Rate	Total Literacy Rate	Male Literacy Rate	Female Literacy Rate	% with Zero-Educational Attainment	% with Incomplete Primary Edu. Attainment	% with Primary Edu. Attainment	% with Sec. Edu. Attainment	% witout Sec. Edu. Attainment	Labour Force Participation Ratio	Male L.force Part. Rate	Female L.force Part. Rate	Total Unemployment Rate	Male Unemployment Rate	Female Unemployment Rate	% with Access to Electricity
1	p	Banteay Mean Chey	40.88	66.90	79.40	55.60	1.62	69.88	19.50	7.28	1.73	55.20	57.70	52.90	8.00	6.30	9.70	12.00
2	p	Bat Dambang	26.41	70.80	82.10	60.70	1.60	63.41	23.13	8.99	2.87	50.70	54.70	46.90	8.00	6.80	9.30	13.90
3	p	Kampong Cham	12.07	64.00	76.10	53.70	2.18	68.81	20.06	7.44	1.50	55.90	57.10	54.80	4.30	3.90	4.60	11.70
4	p	Kampong Chhnang	44.60	63.90	76.50	53.70	2.72	69.89	19.49	6.53	1.36	59.10	57.80	60.30	3.10	2.90	3.20	6.00
5	p	Kampong Spueu	18.18	64.20	79.20	51.60	1.92	65.21	22.47	8.70	1.70	57.00	54.20	59.50	2.80	2.90	2.70	4.00
6	p	Kampong Thum	29.07	60.40	71.30	51.30	2.33	70.69	17.96	7.36	1.65	51.90	54.90	49.20	8.20	6.40	9.90	6.80
7	p	Kampot	18.67	64.30	78.00	53.00	1.40	65.87	22.11	8.66	1.96	56.80	55.90	58.40	3.70	3.60	3.80	6.80
8	p	Kandal	18.40	72.40	83.70	62.80	1.84	61.98	24.05	9.48	2.64	55.10	55.60	54.60	4.90	4.60	5.30	12.80
9	p	Kaoh Kong	8.16	62.50	75.40	48.70	1.97	57.98	26.73	1.017	3.15	53.10	66.40	39.10	9.30	7.40	12.50	38.90
10	p	Kratie	38.59	66.80	75.70	58.40	1.69	66.42	21.68	8.60	1.61	54.60	59.70	49.70	6.90	6.30	7.60	13.50
11	m	Kep	48.97	60.00	74.00	47.80	1.37	67.96	22.47	6.70	1.50	54.70	55.50	53.90	2.00	2.20	1.90	9.20
12	m	Pailin	97.24	72.70	83.80	58.40	3.36	64.68	20.47	8.85	2.38	60.00	70.40	47.30	5..00	4.60	5.70	23.10
13	m	Sihanouk	34.12	70.00	82.80	58.40	1.06	55.98	27.00	11.85	4.10	49.20	57.80	41.00	8.30	6.50	10.80	41.50
14	p	Mondol Kiri	19.87	38.20	52.40	24.00	2.81	56.91	23.67	13.20	3.42	62.90	67.10	58.60	7.30	7.30	7.30	8.60
15	p	Otdar Mean Chey	39.05	46.50	62.20	30.70	2.14	73.83	16.75	5.79	1.50	56.20	59.40	53.00	4.50	3.40	5.70	2.60
16	m	Phnom Penh	11.92	85.00	92.30	78.60	1.13	41.24	28.10	17.40	12.14	49.10	56.30	42.50	12.60	8.90	17.00	80.20
17	p	Pousat	40.74	70.00	82.50	59.50	1.30	68.28	19.60	8.80	2.02	55.60	54.40	56.60	3.50	3.40	5.70	9.60
18	p	Preah Vihear	29.06	56.30	67.90	45.20	2.35	76.20	14.35	5.58	1.52	61.90	63.00	60.90	2.60	2.60	2.60	3.70
19	p	Prey Veng	53.14	68.90	83.60	57.30	1.79	69.62	20.86	6.49	1.25	59.60	55.90	62.80	3.00	3.00	2.90	3.90
20	p	Ratanak Kiri	8.81	27.10	38.90	16.30	3.99	62.93	20.03	10.31	2.75	68.20	69.00	67.30	3.00	3.00	3.00	14.90
21	p	Siem Reap	53.73	52.70	63.90	43.10	2.55	73.22	16.35	5.95	1.93	58.20	59.10	57.40	4.60	3.90	5.30	9.50
22	p	Stueng Traeng	16.37	54.60	65.40	44.50	1.29	66.25	20.43	9.67	2.37	63.90	65.20	62.50	3.30	3.20	3.40	14.10
23	p	Svay Rieng	43.49	72.20	88.20	59.70	1.18	67.04	23.08	7.26	1.44	58.10	53.80	61.90	2.10	2.10	2.10	4.70
24	p	Takeo	15.22	66.50	81.80	54.00	1.43	59.37	27.10	10.09	2.00	56.70	54.00	59.00	3.50	3.50	3.70	4.60

Appendix 5.4

Correlation of Access Indicators

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	0.214	0.229	0.16	0.19	0.39	-0.34	-0.423*	-0.29	0.05	0.11	-0.05	-0.22	-0.22	-0.21	-0.19
	1	0.985**	0.989**	-0.638**	-0.30	0.423*	0.17	0.32	-0.694**	-0.549**	-0.486*	0.30	0.24	0.33	0.40
		1	0.954**	-0.668**	-0.25	0.434**	0.10	0.24	-0.675**	-0.601**	-0.428*	0.21	0.15	0.24	0.31
			1	-0.631	-0.31	0.40	0.20	0.37	-0.692**	-0.565.**	-0.465*	0.33	0.27	0.35	0.431*
				1	0.23	-0436*	-0.16	-0.21	0.620	0.674**	0.27	-0.16	-0.11	-0.19	-0.22
					1	-0.873**	-0.963**	-0.853**	0.35	-0.07	0.473*	-0.	-0.642**	-0.648**	-0.823**
						1	0.750**	0.552**	-0.445*	-0.14	-0.455*	0.451	0.468*	0.461*	0.598**
							1	0.859**	-0.23	0.17	-0.39	0.644**	0.660**	0.632**	0.787**
								1	-0.38	0.04	-0.472*	0.699**	0.634**	0.727**	0.915**
									1	0.586**	0.808**	-0.628**	-0.557**	-0.657**	-0.477*
										1	0.00	0.07	0.14	0.06	0.14
											1	-0.81	-0.769**	-0.834**	-0.682**
												1	0.979**	0.991**	0.757**
													1	0.946**	0.683**
														1	0.804**
															1

1 Poverty Rate
2 Total Literacy Rate
3 Male Literacy Rate
4 Female Literacy Rate
5 % with Zero Educational Attainment
6 % with Incomplete Primary Education Attainment
7 % with Primary Education Attainment
8 % without Secondary Education Attainment
9 % with Secondary Education Attainment
10 Labour Force Participation Rate
11 Male Labour Force Participation Rate
12 Female Labour Force Participation Rate
13 Total Unemployment Rate
14 Male Unemployment Rate
15 Female Unemployment Rate
16 % with Access to Electricity

* Correlation is significant at the 0.05 level (2-tailed), ** Correlation is significant at the 0.01 level (2-tailed)

Appendix 5.5

Food Absorption Indicators

N-0.		Province/ Municipality	Infant Mort-ality Rate	Child Mort-ality Rate	% of Children with Anemia	% of Women with Anemia	% of Children Modera-tely Stunted	% of Children Modera-tely Wasted	% of Children modera-tely Under-weight	0-14sex Ratio Male/Fe-male	% of Population Having Access to Safe Drinking Water	% of Populat-ion Having Access to Toilets
1	p	Banteay Mean Chey	78.20	107.70	61.80	65.40	28.90	19.50	39.50	104.90	19.20	10.40
2	p	Bat Dambang	98.00	126.60	36.00	47.50	36.30	21.10	36.40	104.90	21.70	19.90
3	p	Kampong Cham	107.90	133.80	73.20	58.20	48.20	15.60	47.80	105.10	19.40	9.70
4	p	Kampong Chhnang	129.30	160.00	67.10	51.40	45.90	9.50	46.10	103.20	19.30	6.00
5	p	Kampong Spueu	68.30	89.50	75.70	59.60	44.50	16.90	44.00	103.60	22.40	3.90
6	p	Kampong Thum	64.50	98.80	78.70	66.80	47.20	24.50	49.40	103.90	3.60	13.10
7	p	Kampot	100.40	124.40	58.30	51.40	43.40	9.60	39.80	104.80	13.20	8.00
8	p	Kandal	89.20	108.20	58.30	54.20	46.20	11.80	48.20	105.00	36.30	12.30
9	p	Kaoh Kong	70.70	90.80	62.50	44.40	55.00	14.70	42.70	102.60	36.40	14.70
10	p	Kratie	71.30	119..50	54.10	60.10	51.00	10.90	47.00	104.80	32.80	13.40
11	m	Kep	100.40	124.40	58.30	51.40	43.40	9.60	39.80	107.40	12.40	3.30
12	m	Pailin	98.00	126.60	36..00	47.50	36.30	21.10	36.40	101.60	13.10	19.80
13	m	Sihanouk	100.40	124.40	58.30	51.40	43.40	9.60	39.80	104.80	27.80	25.20
14	p	Mondol Kiri	169.80	229.30	67.10	63.00	55.00	15.20	54.00	103.00	7.60	11.40
15	p	Otdar Mean Chey	77.90	124.60	72.20	69.20	50.70	10.60	49.90	104.60	3.20	2.00
16	m	Phnom Penh	37.60	49.70	41.80	52.60	25.60	18.30	35.00	103.80	85.40	74.90
17	p	Pousat	139.40	172.70	69.20	63.30	46.30	13.40	46.30	104.40	12.30	8.50
18	p	Preah Vihear	71.30	119.50	54.10	60.10	51.00	10.90	47.00	104.40	17.70	4.90
19	p	Prey Veng	111.00	151.30	58.80	54.60	51.20	15.10	56.80	102.90	54.50	4.30
20	p	Ratanak Kiri	169.80	229.30	67.10	63.00	55.00	15.20	54.00	103.90	5.50	9.20
21	p	Siem Reap	77.90	124.60	72.20	69.20	50.70	10.60	49.90	104.30	13.40	6.60
22	p	Stueng Traeng	71.30	119.50	54.10	60.10	51.00	10.90	47.00	105.00	19.20	13.80
23	p	Svay Rieng	102.00	129.60	68.10	63.30	51.30	13.00	45.90	104.10	48.20	8.20
24	p	Takeo	96.00	118.50	65.00	64.60	42.10	17.20	39.90	105.20	12.90	4.30

Source: Col. 1-7, Demographic and Health Survey-Cambodia, 2000; Col. 8-10, General Population Census of Cambodia 1998, Census Tables at National Level Cambodia National Institute of Statistics, Ministry of Planning, Phnom Penh, Cambodia.

Appendix 5.6

Correlation of Absorption Indicators									
1	2	3	4	5	6	7	8	9	10
1	0.953**	0.21	0.05	0.38	-0.13	0.425*	-0.16*	-0.397	0.370
	1	0.23	0.22	0.513*	-0.17	0.583**	0.18	0.471	-0.424**
		1	0.641**	0.522**	-0.15	0.586**	0.00	0.383	-0.531**
			1	0.27	0.01	0.512*	0.08	0.362	-0.329**
				1	-0.444*	-0.793**	-0.15	-0.322	0.599**
1 Infant Mortality Rate 2 Child Mortality Rate 3 % of Children with Anemia 4 % of Women with Anemia 5 % of Children Moderately Stunted 6 % of Children Moderately Wasted 7 % of Children Moderately Underweight 8 Sex Ratio (0-14 years) 9 % of Population Having Access to Safe Drinking Water 10 % of Population Having Access to Toilets					1	-0.22	-0.28**	-0.853**	0.289
						1	0.13**	0.552**	-0.482*
							1	0.859**	-0.54
								1	-0.681**
									1

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Appendix 5.7 - Principal component analysis

Principal component analysis has been carried out to test if the component bunching supports our categorisation of the indicators into food availability indictors, food absorption indicators and food access indicators. The principal component could be used only if the component represents a set of key variables, inseparable for programme implementation. Since that was not the case, we have used this analysis just to examine the clustering of the variables.

Principal component analysis is a method of data reduction. In this example, we are interested in obtaining the component scores to look at the dimensionality of the data. For example, if two components are extracted and those two components accounted for 68% of the total variance, then we would say that two dimensions in the component space account for 68% of the variance. Unlike factor analysis, principal components analysis is not used to identify underlying latent variables. Hence, the loadings onto the components are not interpreted, as factors in a factor analysis would be. Principal components analysis, like factor analysis, can be preformed on raw data, as shown in this example, or on a correlation or a covariance matrix. If raw data is used, the procedure will create the original correlation matrix or covariance matrix, as specified by the user. If the correlation matrix is used, the variables are standardised and the total variance will equal the number of variables used in the analysis (because each standardised variable has a variance equal to 1). If the covariance matrix is used, the variables will remain in their original matrix. However, one must take care to use variables whose variances and scales are similar. Unlike factor analysis, which analyses the common variance, the original matrix in a principal component analysis analyses the total variance. Also, principal component analysis assumes that each original measure is collected without measurement error. In this example we have included many options, including the original and reproduced correlation matrix and the screen plot. While one may not wish to use all of these options, we have included them here to aid in the explanation of the analysis.

First, a correlation matrix is generated for all the variables. A correlation matrix is a rectangular array of the correlation coefficients of the variables with each other. Second, factors are extracted from the correlation matrix based on the correlation coefficients of the variables. Third, the factors are rotated in order to maximize the relationship between the variables. The indicators, which are selected for component analysis, are not correlated. The Kaiser-Meyer-Olkin measure of sampling adequacy is 0.542. Since it is greater than 0.5, it is satisfactory. The Bartlett's Test of Sphericity tests the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is a matrix in which all of the diagonal elements are 1 and all off- diagonal elements are 0. We want to reject this null hypothesis. The probability is less than 0.05 and hence we reject the hypothesis, i.e., the correlation matrix is not an identity matrix.

These tests provide a minimum standard, which should be passed before a principal component analysis (or a factor analysis) is conducted. The next item from the output is a table of communalities, which shows how much of the variance in the variables has been accounted for by the extracted factors. For instance over 83% of the variance in access to toilets is accounted for while 84.7% of the variance for literacy is accounted for.

Total variance explained

The next item shows all the factors extractable from the analysis along with their eigen values, the percent of variance attributable to each factor, and the cumulative variance of the factor and the previous factors. Notice that the first factor accounts for 36.99% of the variance, the second 14.13% and the third 13.18%. All the remaining factors are not significant.

Component (factor) matrix

The table below shows the loadings of the ten variables on the three factors extracted. The higher the absolute value of the loading, the more the factor contributes to the variable. The gap on the table represent loadings that are less than 0.5, this makes reading the table easier. We suppressed all loadings less than 0.5.

Rotated component (factor) matrix

The idea of rotation is to reduce the number factors on which the variables under investigation have high loadings. Rotation does not actually change anything but makes the interpretation of the analysis easier. Looking at the table, we can see that *poverty* is loaded on Factor (Component) 3, while deficit of production over consumption, percentage of women with anaemia, and juvenile sex ratio are substantially loaded on Factor 2. All the remaining variables are substantially loaded on Factor 1. These factors can be used as variables for further analysis.

The results show that the first 4 components explain 74% of the variations. When we restricted the number of components to three, we find that the groupings are almost equal to our categorization of the indicator in availability, access and absorption. Component three that contains only poverty comes out separate with one indicator. This component can be tagged as Food Access or Livelihood Access component, where income poverty is the most important factor. The second component with deficit in production and juvenile sex ratio could be considered as an availability component as deficit of production over consumption seems to carry more weight. The first component could be considered as an absorption component. The analysis only shows that when we use the indicators without any correlation with each other, they are bunched in a manner that shows that our choice of indicators for each category is fairly good, with limited overlap due to the interrelationships between the categories.

Table 1 - KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.54
Bartlett's Test of Spehericity	Approx Chi-Square	94.64
	df	45.00
	Sig.	.00

Source: Calculated from the Province Level Data

Table 2 - Communalities

	Initial	Extraction
Deficit in Production	1.000	0.547
Poverty	1.000	0.795
Literacty	1.000	0.847
Unemployment	1.000	0.639
IMR	1.000	0.459
Woman-anemia	1.000	0.454
Child-stunted	1.000	0.714
J.sexratio	1.000	0.530
Drinking Water	1.000	0.610
Toilets	1.000	0.836

Extraction Method: Principal Component Analysis.
Source: Calculated from the Province Level Data.

Table 3 - Loadings of the variable

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Comp-onent	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.70	36.999	37.00	3.70	37.00	37.00	3.35	33.541	33.54
2	1.41	14.13	51.128	1.41	14.13	51.13	1.66	16.55	50.09
3	1.32	13.18	64.305	1.32	13.18	64.31	1.42	14.21	64.31
4	1.00	9.96	74.268						
5	0.88	8.75	83.018						
6	0.71	7.06	90.079						
7	0.50	4.97	95.046						
8	0.27	2.69	97.738						
9	0.15	1.48	99.216						
10	.078	.78	100.000						

Extraction Method: Principal Component Analysis. Source: Calculated from the Province Level Data

Table 4 - Component Matrix (a)

	Component		
	1	2	3
Deficitprod			0.647
Poverty		-0.823	
Literacty	0.777		
Unemployment	0.711		
IMR	-0.611		
Woman-anemia	-0..514		
Child-stunted	-0.718		
J.sexratio		0.624	
Drinking Water	0.775		
Toilets	0.868		

Extraction Method: Principal Component Analysis.
(a) 3 components extracted.
Source: Calculated from the Province Level Data.

Table 5 - Rotated Component Matrix (a)

	Component		
	1	2	3
Deficitprod		0.734	
Poverty			-0.889
Literacty	0.871		
Unemployment	0.558		
IMR	-0.657		
Woman-anemia		0.514	
Child-stunted	-0.829		
J.sexratio		0.555	
Drinking Water	0.687		
Toilets	0.711		

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