# Drought Management Considerations for Climate Change Adaptation: Focus on the Mekong Region

## CAMBODIA report

Oxfam Cambodia and Graduate School of Global Environmental Studies of Kyoto University, Japan

**Disclaimer:**



**Contact:**

International Environment and Disaster Management (IEDM)
Graduate School of Global Environmental Studies, Kyoto University
Yoshida Honmachi, Kyoto, Japan 6068501
Website: http://www.iedm.ges.kyoto-u.ac.jp/

Oxfam GB in Cambodia
#442, St 193, Toul Svay Prey I
Chamkarmon, Phnom Penh, Cambodia
P.O. Box 883, Phnom Penh

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# Foreword

The Mekong plays an important role in the well-being of China, Cambodia, Laos, Burma, Thailand, and Viet Nam as it is the major river supporting agriculture and many other economic activities in the region. The Mekong is also a cause of concern for many people, due to the regular floods it brings to the region, which have a significant impact on the lives of many in the river basin. However, in recent times, the Mekong River basin has become increasingly vulnerable to drought. A notable example was the drought of 2004, which began a couple of years earlier and grew to serious proportions. Dealing with drought requires strategies different from those for dealing with floods and typhoons, which have plagued the Mekong region for years. Local communities, governments, and NGOs know how to deal with these age-old problems but drought, being a slow-onset disaster with crippling impacts, needs to be looked at from a different perspective.

This study from Cambodia follows a study done in Viet Nam, the result of collaboration between Oxfam GB in Viet Nam, Oxfam GB in Cambodia, and the International Environment and Disaster Management (IEDM) laboratory of the Graduate School of Global Environmental Studies (GSGES), Kyoto University, Japan. That study investigates some aspects of the recent droughts in the Mekong region and tries to establish their likely causes and how such incidents could best be mitigated. It contains valuable observations on how communities perceive drought and climate change and on how local governments and NGOs can help to manage climate-related such as drought. It points out that the impacts of drought are in a real sense a reflection of developmental problems, and provides policy options that could be implemented by local communities, governments, and NGOs.

Chapter 1 introduces the background to the work and its objectives and aims, describes the methodology used, and provides an overview of the study locations. Chapter 2 provides an overview of Svay Rieng province, outlining its developmental context. Chapter 3, on disaster and climate-change vulnerability, discusses the current status of various disasters and offers future projections of climate change. It also makes some interesting observations on climate data, as perceived by local communities. The results of the study are discussed in detail in Chapter 4, while policy options for dealing with drought risks are presented in Chapter 5.

This is ongoing pilot work, and we hope that it will help to improve our understanding of the problems and help to initiate development programmes by bringing various stakeholders together. Any feedback is greatly appreciated.

Research Team

**IEDM/GSGES/Kyoto University**

Prof. Rajib Shaw, Associate Professor
Dr. S.V.R.K. Prabhakar, Postdoctoral Fellow
Mr. Huy Nguyen, Research Student

**Oxfam GB in Cambodia**
Francis Perez
Country Programme Manger, Oxfam GB

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Research Team

**IEDM/GSGES/Kyoto University**

Prof. Rajib Shaw, Associate Professor
Dr S.V.R.K. Prabhakar, Postdoctoral Fellow
Mr Huy Nguyen, Research Student

**Oxfam GB**

Francis Perez, CPM Cambodia
Provash Mondal, HPC Viet Nam

# Executive summary

Cambodia is one of the most disaster-prone countries in East Asia, with its vulnerability to annual floods and droughts. One of the reasons why it is vulnerable to natural disasters is that the livelihoods of the majority of people depend directly upon natural resources, with a large proportion of its population occupied in agriculture and related sectors, including animal husbandry. Extreme poverty, which limits access to food, water, and other basic amenities, increases vulnerability. These characteristics heighten Cambodia's exposure to the impacts of climate change too. The Mekong region has recently been showing signs of climate change, as illustrated in our previous report on Viet Nam ('Drought-Management Considerations for Climate-Change Adaptation: Focus on the Mekong Region – Report (Viet Nam)', October 2007). There is evidence of greater climatic extremes: both declining rainfall in the dry season and more violent rainfall in the wet season, causing flash floods. Increasingly powerful typhoons also appear to be occurring.

Meteorological data in Cambodia is especially poor, and climate predictions are uncertain; therefore it is important to strengthen the resilience of communities to help them to cope with existing challenges to their livelihoods. That will boost resilience to whatever shocks the future holds. Identifying appropriate adaptation options which are 'win–win' in nature will enhance capacities in Cambodia and indicate ways forward for other developing countries. Identifying and designing such adaptation options, bearing in mind the need to ensure the sustainable development of these countries, is a huge task, which needs stakeholders to work together. Such a partnership needs to identify both the climatic vulnerabilities and the underlying socio-economic factors that cause or increase vulnerability, then begin to design and implement long-term sustainable interventions that will reduce the risks of disaster. Climatic extremes and other crises will still happen, but they need not result in disasters – that is, loss of life and serious socio-economic damages – if the right measures are in place.

To this end, Oxfam in Cambodia and Kyoto University, Japan have come together to study the climatic vulnerabilities of rural communities in Svay Rieng, one of the most drought-prone provinces in the country, and to identify interventions that may help to reduce those vulnerabilities. Considered as a pilot initiative, the work has identified some characteristics of rural communities that made them chronically vulnerable to climatic events such as drought. The study was designed to strike a balance between analysing climatic information and considering the perceptions of local communities about their climate. Much emphasis was also placed on the identification of gender-disaggregated impacts of drought, with the aim of making future planning more gender-sensitive.

If there is good news from this study, it is perhaps that climate changes in Svay Rieng province seem not as marked, and are harder to discern, compared with the findings of our previous study in Ninh Thuan province in Viet Nam – an area similarly prone to recurrent droughts. Meteorological data is fairly scanty for Svay Rieng, existing only on a provincial scale, but it does not appear to demonstrate marked changes in temperature or rainfall. Communities interviewed similarly displayed considerable uncertainty and disagreement over whether, and how far, their climate might be changing. As has been said, drought and flood are already fairly common occurrences, and communities found it hard to convincingly identify the occurrence of either increased drought or increased rainfall and floods. However, a majority of people did feel that rainfall is declining, temperatures are rising, and drought is becoming more common. They particularly identified changes in onset and withdrawal patterns, and changes in the seasons, with impacts on crops, saying that the rainy seasons are increasingly delayed, and that the dry seasons have become prolonged. They also say that levels of biodiversity are declining. People identified

deforestation as both the most important factor behind the changes they observed and – overwhelmingly – the main reason why they are vulnerable to drought. There are some differences between the two study locations which may illustrate the importance of understanding micro-climates in the province. Generally, the observations of people in Svay Rieng, notably about changes to seasons, are very similar to observations reported by people in many other countries where Oxfam works, including Nicaragua, Uganda, India, and Viet Nam.

A major finding of the study is that whatever the current climate trends, communities are highly vulnerable to the impacts of even small and subtle changes in climate. Drought has been extremely common in Svay Rieng and if temperatures continue to rise, and if the current socio-economic situation persists, this study shows that life will become considerably harder for communities, unless measures can be taken to reduce their vulnerabilities and assist their livelihoods.

Drought poses a particular challenge. Its impacts are severe in every respect: economic losses, health problems, social tensions, and environmental damage. All these make recovery from drought more difficult. Women suffer particularly badly. Even if future climates tend to be wetter in some aspects, rainy seasons may be shorter and more intense, creating problems for agriculture. Furthermore, drought is only partly a result of low rainfall as such; drought is also due to water management, storage, and access. If water resources from rivers, lakes, aquifers, and so on are insufficient, or inaccessible, then a state of drought may be declared. It would therefore be timely and cost-effective to develop the capacity of the whole system in Svay Rieng to cope with current challenges – before climate change makes those challenges even more daunting.

In identifying the root causes of vulnerability, it was apparent that communities saw poor or delayed rainfall as only one issue. Communities consistently identified such factors as poverty, the high cost of inputs, poor access to seeds or irrigation, and lack of alternative income-generating opportunities as key factors underlying their vulnerability.

Two kinds of adaptation strategy were identified in the study locations: *autonomous adaptation options* and *planned adaptation options.* The former include storing seed and fodder for the next season, selecting different crops, and diversifying livelihoods. The latter, planned by government and NGOs, include digging wells and providing pump sets and better crop seeds. In practice, though, the boundaries between the two types of strategy are blurred. However, no significant investment in drought-mitigation programmes was found in the study areas. Despite the regular occurrence of drought in Svay Rieng, drought preparedness and response on the part of government and agencies appears to be weakly developed. Some of the most important deficiencies have been the absence of a dependable drought-forecasting mechanism, the lack of a clear definition of drought, and the lack of a consistent response mechanism. Drought response, such as it is, has often resulted in short-lived solutions. This is somewhat in contrast to flood response; floods are more obvious phenomena and response mechanisms are better developed.

The lack of sufficient livelihood-diversification options in the rural areas has forced populations to migrate to urban areas – a trend which leads to various kinds of social stress. Irrigation systems in particular, and water-harvesting systems in general, need a big boost. There is a need to map the existing capacities of communities and undertake a long-term capacity-building programme in consonance with market development to improve income generation and general well-being.

# 1. Introduction

Cambodia is one of the most vulnerable countries in Asia to various kinds of natural disaster. It is vulnerable to floods and droughts, and sometimes to both in the same year.[1] Its vulnerability has increased in recent years because a series of almost consecutive annual disasters has not allowed people the chance to recover from previous floods or droughts. This makes it necessary to study the importance of climate change in relation to the changing vulnerability of communities to climatic events, and to establish what they think about it and what they plan to do.

There are different aspects to Cambodia's high level of vulnerability to climatic events. Two important factors seem to be the high rate of poverty and the high proportion of the population who are dependent on agriculture. In 2004, 84 per cent of Cambodia's population were engaged in agriculture, though contributing only around 31.1 per cent of the country's GDP.[2] Levels of absolute poverty in Cambodia are startling. According to the World Bank's Poverty Assessment for 2006, some 35 per cent of all households in Cambodia are rated as poor.[3] The combination of high poverty levels and a high dependency on agriculture has made the country extremely vulnerable to climatic events such as recurring floods and droughts.

Climate change has brought a new dimension to the problem. A number of climate change-related impacts have already been observed in the Mekong River region. Climate change seems to be one factor influencing a significant reduction in water supply in the Upper Mekong, water shortages in dry seasons, and a deterioration in water quality.[4] The flow of water in the Mekong River is hugely significant for Cambodia as a whole, and it is essential that such impacts on the country are better understood. There is a need for a comprehensive study at the national level to answer broader questions. The current study, however, focuses mainly on the impacts of climate change on disaster profiles at the local level, the vulnerabilities of communities to climatic events, communities' beliefs about climate change and its relation to their own vulnerability, and on identifying solutions for reducing their vulnerability.

## *1.1. Aim and objectives*

### 1.1.1. Aim

The aim of this study is to understand the factors contributing to climate vulnerability and to improve resilience mechanisms in some of the most climate risk-prone areas in Svay Rieng province, Cambodia. The study is regarded as a pilot initiative, with the aim of understanding various issues related to climate change and drought risk reduction, so that areas of focus for intervention in climate risk-prone areas can be identified and implemented with a long-term perspective.

### 1.1.2. Objectives

The specific objectives in achieving the aim above were to:

1. Assess the climate vulnerability of rural communities in the most drought-prone areas of Svay Rieng province, Cambodia (to meet this objective, surveys were conducted among local communities to determine their perceptions of how climate risk shapes their vulnerabilities).
2. Identify possible adaptation measures to mitigate the impacts of ever increasing climate variability and change on rural communities, in particular the effects of drought, with an emphasis on identifying impacts on a gender-disaggregated basis (this objective was met through systematic use of the 'How to Reduce Drought Risk' tool developed by the Preparedness and Mitigation Working Group of the Western Drought Coordination Council, USA[5]).

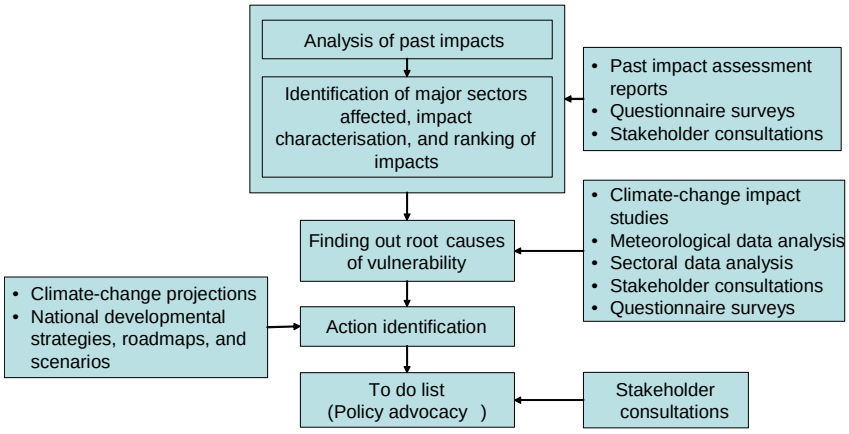
## 1.2. Research methodology

Due to the interdisciplinary nature of the problem, the project employed a mix of vulnerability assessment methodologies. Much of the methodology was drawn from the 'How to Reduce Drought Risk' tool of the Western Drought Coordination Council, which is a simple step-by-step process that can be used (by communities, local, provincial, and national governments, NGOs, and other institutions) to identify actions that can reduce impacts. In addition to this tool, a combination of participatory rural appraisal techniques was used in the study, including questionnaire surveys, participatory focus group discussions, transect walks, etc. (see below for more detail).

## 1.2.1. Research components

Figure 1 depicts the components of the methodology followed in the study. The methodology was based on the past impacts of drought to reflect the local vulnerabilities of communities, institutions, and governance mechanisms.

**Figure 1: Components of the research methodology**




### Impact assessment

Taking impacts as its starting point, the study investigated whether their root causes might be institutional and sectoral inefficiencies, community vulnerability factors, or factors related to climate. In areas where past impact assessments could not be obtained or where sufficient information was not available, information from the questionnaire surveys, group discussions, and existing literature was used to supplement the process. Due emphasis was given to gender-related issues.

### Impact characterisation

Based on the impact assessment, the sectors impacted by past droughts were identified and ranked in order of importance. The ranking was based on the extent of impact on a particular sector and its relative importance to the general well-being of communities in the region. Impacts were ranked in their relative degree of importance, based on consultation with the stakeholders. Efforts were also made to identify whether certain kinds of impact were becoming more of a problem than others.

### Finding root causes

The differential degree of impacts is related to the different root causes of vulnerability. Among the root causes identified were a lack of irrigation facilities, the cultivation of susceptible crops or mismanagement of cropping systems, a lack of dykes to stop floods, an absence of coastal-belt plantations, etc. In order to identify root causes, discussions were held with communities, institutions, and local government officials. 'Problem trees' and 'impact trees' were constructed, based on discussions with stakeholders, and the root causes or underlying factors were identified.

### Identifying appropriate actions

Appropriate actions were identified based on the above analysis. This was done by developing a matrix listing the different impacts and their root causes (vulnerabilities). This process also considered potential mitigations of climate-change impacts.

### Policy advocacy

While this study stops at the stage of identifying appropriate actions, advocacy on policy or preparation of a concrete 'to do' list would require all stakeholders to sit down together to discuss possible outcomes of the above analysis. We suggest that stakeholders should consider these findings and prioritise actions to be taken based on available resources.

## 1.2.2. Study locations

Four villages in two communes, in two different districts, were identified in Svay Rieng province. Table 1 provides information on the study locations. More detailed information on Svay Rieng province is provided in Chapter 2. Data were collected from each village listed in Table 1 and then averaged to represent the communes and districts in general. It should be noted that the sample size of two villages is not sufficient to represent the true size and diversity of districts or to draw conclusions about the province as a whole, and hence should be considered as a limitation set by time and financial constraints. The research was carried out in March–April 2007.

**Table 1: Study locations**

| Province | Districts | Communes | Villages |
|---|---|---|---|
| Svay Rieng | Romeas Haek | Andoung Pou | Thmei<br>Roung Snao |
| | Rumduol | Sangkae | Ta Naeng<br>Kouk Srama |

## 1.2.3. Overview of respondents

### Community respondents

The research was undertaken by conducting questionnaire surveys of 301 respondents from the four villages in two districts. Respondents were randomly selected. Table 2 provides an overview of respondents. The majority of respondents were farmers, with a marginally higher proportion of farmers in Romeas Haek district than in Rumduol district. The majority of respondents were also young (72 per cent). There were more females (64 per cent) than males (36 per cent). Seventy-two per cent of respondents were educated to primary school level and 12 per cent to secondary school level.

**Table 2: Overview of community respondents**

| | Romeas Haek district | | Rumduol district | | Combined | |
|---|---|---|---|---|---|---|
| **Occupation** | **Percentage** | | **Percentage** | | **Total** | **Average %** |
| Farmers | 138 | 98 | 146 | 91 | 284 | 95 |
| Landless labourers | 1 | 1 | 9 | 6 | 10 | 3 |
| Employed workers | 1 | 1 | 6 | 4 | 7 | 2 |
| **Gender** | | | | | | |
| Male | 52 | 37 | 59 | 36 | 111 | 37 |
| Female | 88 | 63 | 102 | 64 | 190 | 64 |
| **Education** | | | | | | |
| Illiterate | 10 | 8 | 20 | 13 | 30 | 10 |
| Primary | 107 | 76 | 108 | 67 | 215 | 72 |
| Secondary | 14 | 10 | 23 | 15 | 37 | 12 |
| High school | 9 | 7 | 8 | 5 | 17 | 6 |
| University | 0 | 0 | 1 | 1 | 1 | 0 |
| **Age group** | | | | | | |
| Young (20–50 years) | 101 | 72 | 119 | 73 | 220 | 72 |
| Old (>50 years) | 39 | 29 | 42 | 28 | 81 | 28 |

## Focus group discussions

Focus group discussions (FGDs) were conducted in the two districts with 114 participants (48 males and 66 females), representing the four villages. The majority of participants were farmers (93.9 per cent).


**Plate 1: Participants in a focus group discussion**

**Table 3: Composition and characteristics of focus group participants**

| Item | Male | Female |
|---|---|---|
| **Age** | | |
| <30 | 8 | 7 |
| 30–50 | 19 | 34 |
| >50 | 18 | 15 |
| **Education** | | |
| Illiterate | 4 | 28 |
| Primary | 24 | 27 |
| Secondary | 20 | 9 |
| High school | 0 | 1 |
| **Occupation** | | |
| Farmer | 43 | 64 |
| Small trader | 3 | 0 |
| Student | 1 | 0 |
| Handicraft worker | 0 | 2 |
| Construction worker | 1 | 0 |
| **Economic condition** | | |
| Poor | 26 | 38 |
| Medium | 22 | 28 |

### Government and community-based organisations

The profile of government respondents is given in Table 4. A total of 12 officials of government and community-based organisations were interviewed, using structured questionnaires and personal interviews. The information obtained from government officials is provided in box format spread throughout the report; no separate section could be assigned to this group due to a shortage of information.

**Table 4: Profile of respondents representing government and community-based organisations**

| Administrative boundary | Affiliation/Department | Number of respondents |
|---|---|---|
| Village | Village leader | 4 |
| Commune | People's Committee | 4 |
| District | People's Committee<br>Department of Agriculture | 2 |

## 1.2.4. Meteorological data

The number of working meteorological stations measuring rainfall in Svay Rieng province is limited. There were seven rainfall stations in the 1990s, but this has since declined to three stations for the whole province, and only one has a full set of data recorded since 1982. Similarly, air temperature has only been recorded in one location, from 1990.

## 1.2.5. Data collection procedure

Participatory rural appraisal techniques were employed in the study, including structured questionnaire surveys, meetings, focus group discussions, and transect walks to familiarise the researchers with local conditions. Interviews and group discussions were conducted with elected commune leaders, commune-, district-, and provincial-level authorities, officers of the Department of Meteorology and Department of Agriculture Fishery and Forestry, and NGOs (PADEK) active in study locations.

**At the provincial level,** individuals were interviewed and secondary data were collected from the representatives of the Provincial Department of Agriculture, Svay Rieng.

**At the district level,** individuals were interviewed and secondary data were collected from the representatives of District People's Committees and the Department of Agriculture.

**At the commune level,** individual interviews were conducted and secondary data were collected from the representatives of commune People's Committees.

**At the village level,** interviews were conducted with village heads and with households. Impact ranking exercises were carried out based on group meetings.

Field volunteers were recruited to implement the questionnaire survey. The volunteers were given a day-long orientation on the objectives of the study and on how to implement the questionnaire.

Information was also obtained from the head of the Provincial Department of Agriculture, the Director of Svay Rieng Department of Water Resource and Meteorology, the Chairman of Romeas Haek district, the head of the Agriculture Department in Rumduol district, and the Chairmen of Andoung Pou and Sangkae communes.

# 2. An overview of Svay Rieng Province

Svay Rieng province is located to the south-east of the capital city Phnom Penh, and occupies a lowland plain. The provincial town lies 125km from Phnom Penh along National Road No 1. The province is bordered by Prey Veng province to the west and Kampong Cham province to the north, with Viet Nam to the east. It covers an area of 2,966.4 sq km, of which 67 per cent is arable land and 13 per cent is forested.[6]

Svay Rieng province lacks sufficient water resources. It has only two main natural sources of water: the Vay Ko River, whose storage capacity has in recent years declined drastically, rendering it useless during the dry season, and Kampong Trach River, which runs through Romeas Haek district.

## *2.1. Climate and meteorology*

Cambodia has a tropical monsoon climate with distinct wet and dry seasons.[7] During the wet season, from May to early October, rainfall is largely derived from the south-west monsoon drawn from the Indian Ocean. The dry season, from November to April, is associated with the north-east monsoon and is characterised by drier and cooler air.[8] Levels of rainfall vary from 1,100 mm to 2,200 mm, with an annual average of 1,729 mm.

The climate in Cambodia, and throughout Svay Rieng province, is governed by monsoon winds that blow alternately from the north-east and south-west. The rainy season begins with the arrival of the south-west monsoon in May and continues until late September. The north-east monsoon is characteristically colder and drier and lasts from November to March. April and October are transitional periods with unstable conditions.[9]

Temperatures in Svay Rieng are high except during the early part of the north-east monsoon (November–December), when winds from Central Asia bring somewhat cooler air. The temperature increases gradually until February; under the influence of light southerly winds the weather becomes very hot. Rainfall varies considerably throughout the country. In Svay Rieng, annual rainfall ranges from 1,600–1,800mm. The annual average temperature is 28°C, with a maximum average of 38°C in April and a minimum average of 17°C in January.

## *2.2. Socio-economic conditions*

### 2.2.1. Population

The population of Svay Rieng province was 535,656 in 2005, accounting for 3.88 per cent of Cambodia's total population (4.2 per cent in 1998). It had a density of just over 180 people per sq km, higher than the national average. The male population was nearly 256,000 and the female population nearly 280,000. The population of Svay Rieng increased by 32,576 between 1998 and 2005, when censuses were taken. The province consists of seven districts, 80 communes, and 690 villages.[10]

### 2.2.2. Households

#### Total number of households and average household size

The total number of normal or regular households in the province (i.e. excluding institutionalised, homeless, boat dwellers, and transient persons) is 111,426, comprising a total population of 535,656, with an average household size of 4.8 people.

## Male- and female-headed households

The percentages of female-headed and male-headed households were 18.5 per cent and 81.5 per cent respectively in 2005. About 65.6 per cent of female heads of households were aged 40 and above. In the case of male-headed households, the corresponding percentage was only 42.1 per cent.

## Age, sex, and marital status distribution

Children (age 0–14) formed 32.5 per cent (44.8 per cent in 1998) of the province's total population in 2005. The economically productive age group (15–64) accounted for 61.1 per cent (52 per cent in 1998), and elderly people (aged 65 and over) formed 6.4 per cent of the population (3.2 per cent in 1998). People aged 18 years and above (the voting age group) constituted 47.9 per cent of the total.

## Migration

The number of migrants, i.e. those whose previous residence was outside the place of enumeration, was 164,430 in 1998 or 34.4 per cent of the province's population. Males constituted 45 per cent of migrants, females 55 per cent. The percentage of migrants in urban areas (57.3 per cent) was higher than in rural areas (33.3 per cent). Most migrants had moved from other provinces.

**Table 5: Distribution of migrants by previous residence in Svay Rieng province (Census, 1998)**

| Previous residence | Percentage of migrants | | |
|---|---|---|---|
| | Both sexes | Males | Females |
| Within the province | 32.1 | 37.3 | 27.9 |
| From another province | 57.7 | 52.5 | 62.0 |
| From outside Cambodia | 10.2 | 10.2 | 10.1 |


**'We have three children. We only have sufficient food for 2–3 months in a year. My husband had to migrate to Phnom Penh in search of a job. My daughter had to stop going to school to help us in collecting and selling animal manure to buy food.'**

*Ech Savuon. Thmei village, Andong Pou commune, Romeas Haek*

**Plate 2: Ech Savuon with her children in front of their thatched house**

Two main reasons emerge for migration. One is 'family moved', in which female migration is higher. The second is 'repatriation/return after displacement', which accounts for the largest numbers of migrants.

**Table 6: Reasons for migration in Svay Rieng (Census, 2005)**

| Reason for migration | Both sexes | Males | Females |
|---|---|---|---|
| Transfer of workplace | 3.8 | 7.2 | 1.1 |
| In search of employment | 5.3 | 8.0 | 3.1 |
| Education | 1.1 | 2.1 | 0.4 |
| Marriage | 13.4 | 19.3 | 8.5 |
| Family moved | 26.8 | 14.1 | 37.2 |
| Natural disasters/insecurity | 11.0 | 11.5 | 10.5 |
| Repatriation/return after displacement | 36 | 35.5 | 36.6 |
| Other reasons | 2 5 | 2.3 | 2.6 |
| Total | 100 | 100 | 100 |

## 2.2.3. Literacy

The numbers and percentage of people who are literate are given, by sex, in Table 6. In general, male literacy rates are considerably higher than for females.

**Table 7: Education facilities in Svay Rieng province (Census, 2005)**

| Item | Number |
|---|---|
| Primary school classrooms | 1,996 |
| Secondary school classrooms | 542 |
| Primary classes | 2,673 |
| Secondary classes | 742 |
| Primary school teachers | 2,599 |
| Secondary school teachers | 1,346 |

**Table 8: Literacy rates in Svay Rieng province (Census, 2005)**

| Sex | Total/urban/rural | Population aged 7+ | Literate population | Percentage literate |
|---|---|---|---|---|
| Both sexes | Total | 385,513 | 258,753 | 67.1 |
| | Urban | 17,728 | 14,508 | 81.8 |
| | Rural | 367,785 | 244,245 | 66.4 |
| Male | Total | 177,995 | 138,214 | 77.7 |
| | Urban | 8,522 | 7,527 | 88.3 |
| | Rural | 169,473 | 130,687 | 77.1 |
| Female | Total | 207,518 | 120,539 | 58.1 |
| | Urban | 9,206 | 6,981 | 75.8 |
| | Rural | 198,312 | 113,558 | 57.3 |

A small percentage (1.2 per cent) of the literate population has acquired literacy without passing any grade or class.

### 2.2.4. Drinking water facilities

The number of families with access to piped water, private pump well, or a private ring well less then 150 metres from their home, and usable all year round, was 98,270 (88.2 per cent). The number of families with access to a shared tap, pump well, or ring well within 150 metres of their home, and usable all year round, was 11,305 (10.1 per cent). The number of families using water sources such as ponds, rivers, and rainwater was 1,851 (1.7 per cent).[11]

### 2.2.5. Energy for lighting and cooking

Most households in the province use kerosene lamps for lighting. The percentage of households using electricity from a general electrical power source and/or generator was 4.7 per cent. The corresponding percentage in urban areas was 63.2 per cent. Most households use firewood as the main fuel for cooking. The proportion of households using charcoal is higher in urban areas.

**Table 9: Distribution of households by main type of fuel for cooking, Svay Rieng province**

| Total/urban/rural | Firewood | Charcoal | Kerosene | Liquefied petroleum gas (LPG) | Others |
|---|---|---|---|---|---|
| Total | 89.4 | 0.6 | 1.4 | 0.5 | 8.1 |
| Urban | 89.9 | 6.4 | 1.2 | 2.5 | 0.0 |
| Rural | 89.3 | 0.4 | 1.4 | 0.4 | 8.5 |

## *2.3. Main livelihoods*

### 2.3.1. Agriculture

The agricultural sector contributes more than half of Svay Rieng's GDP and constitutes the main livelihood for most of its population, with approximately 90–95 per cent engaged in agriculture-related activities. Rice is the most important crop grown in the province, with more than 93 per cent of households cultivating rice during the wet season.[12] In 1993, rice productivity in Svay Rieng was one of the lowest in Cambodia at 0.95 ton per hectare. This low yield was due to poor water management, low levels of technology inputs, and poor seed quality.[13] However, during the past 15 years, rice production has grown significantly, as a result of increases both in the area cultivated and in productivity. Rice yields have risen from 0.95 to 1.74 tons per hectare, due to increased use of fertilisers and the use of better technology to protect crops from pests and diseases.

**Figure 2: Area (ha) and yield (tons/ha) of rice in Svay Rieng province since 1993**

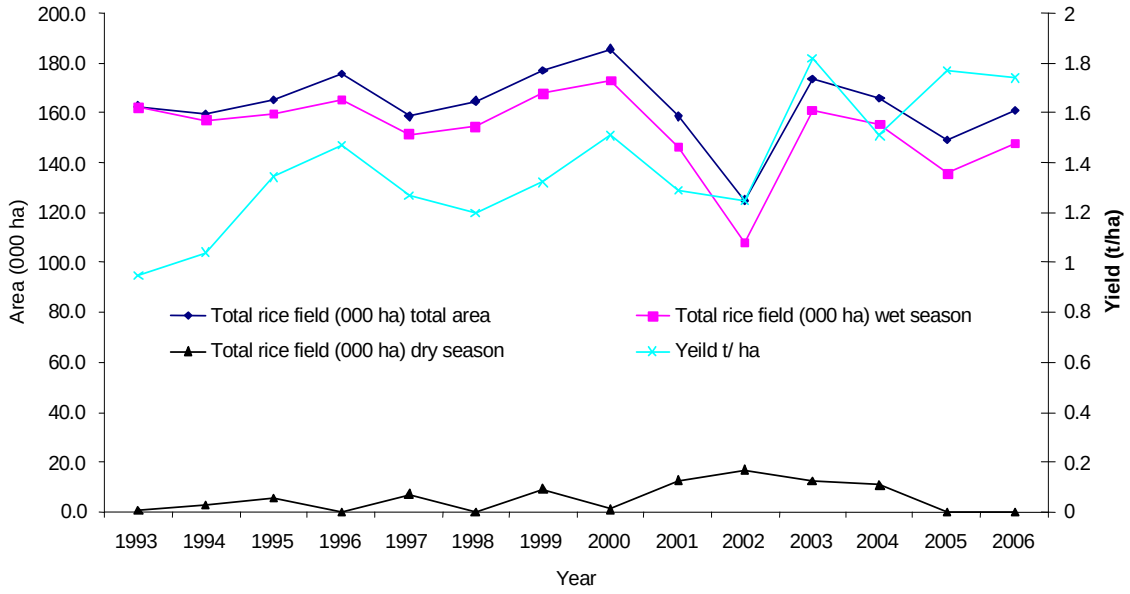
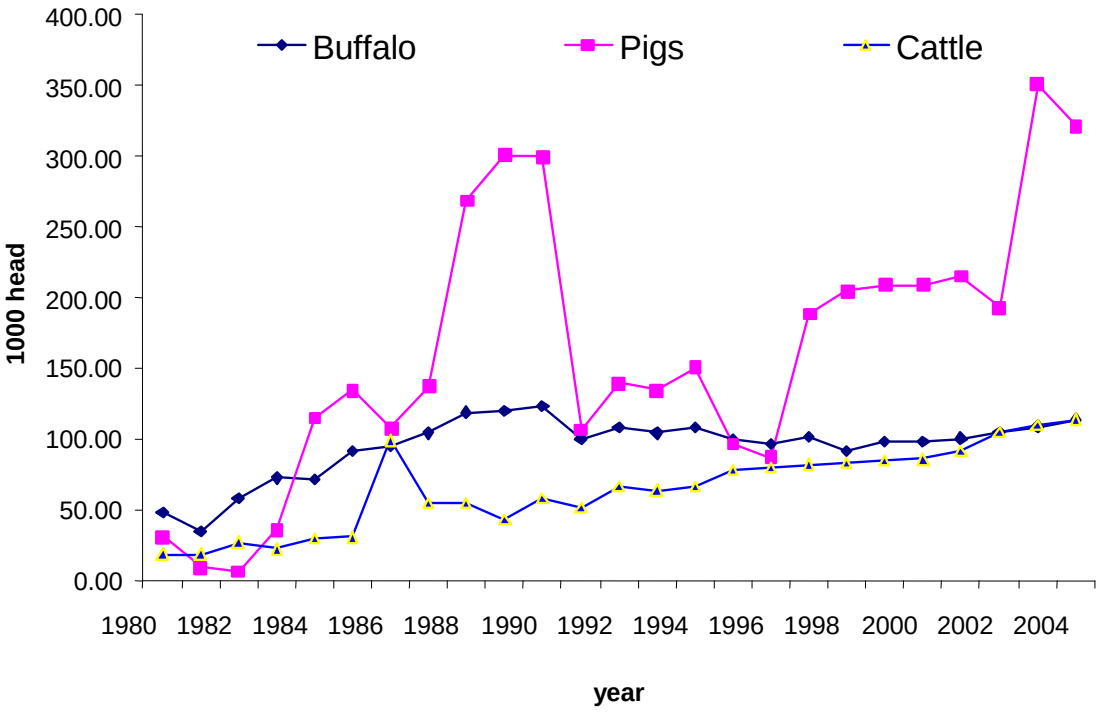



**Figure 3: Change in number of domestic animals in Svay Rieng province since 1980**



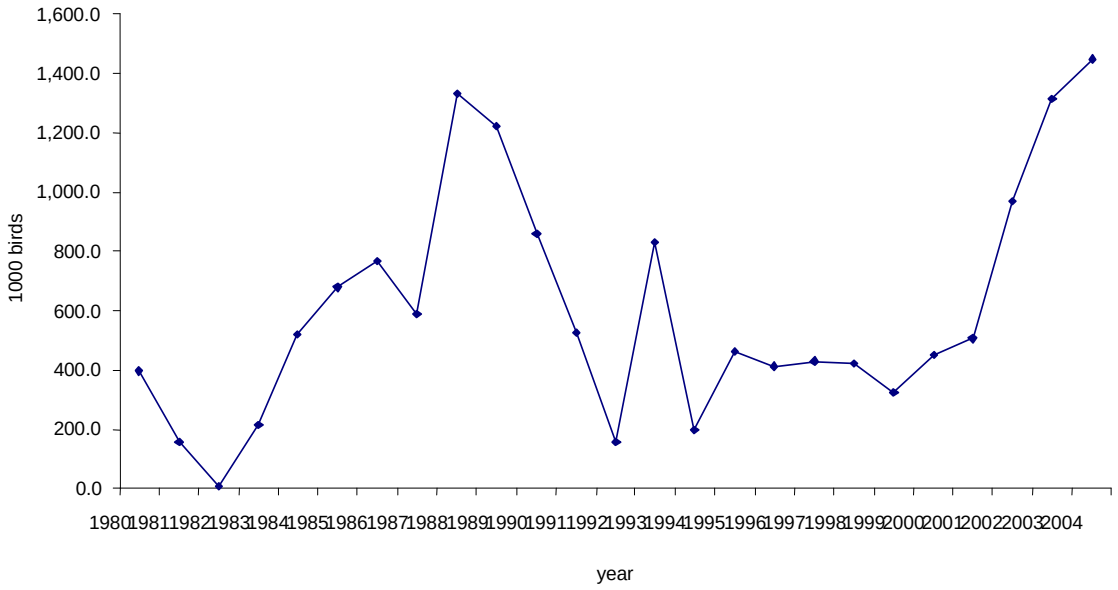

## 2.3.2. Animal husbandry

Livestock kept in Svay Rieng have many uses, providing cash income, draught power, organic fertiliser, and a protein supplement in household diets. Animals are reared mainly on a non-intensive basis on traditional family smallholdings. Animal ownership varies according to wealth. Poor families commonly keep chickens and may rear one or two pigs; poultry are free range and

are not usually penned at night. Rich farmers often have a pair of draught buffalo and breeding cattle, which they sometimes give to poor farmers for share farming.

Poultry rearing is an important livelihood activity for communities. Almost all households keep poultry, as a small-scale animal husbandry practice appropriate for poor households who do not have enough capacity to invest in larger ventures such as rearing cattle and buffalo.

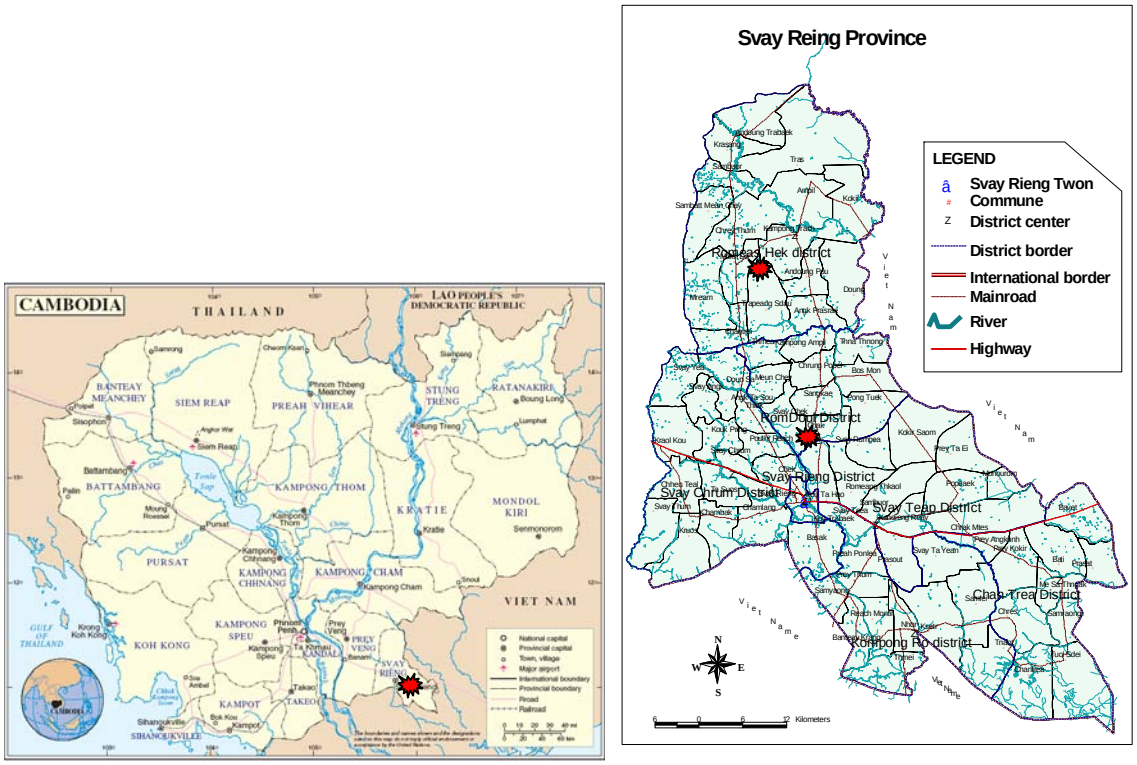
**Figure 4: Poultry in Svay Rieng province**




## *2.4. An overview of Andoung Pou commune*

Located in the north of Svay Rieng province, Andoung Pou is one of 16 communes in Romeas Haek district. According to data from Cambodia's 2005 national census, there were 1,186 households in the commune comprising 5,719 people; approximately 12 per cent were illiterate. The main livelihoods pursued by the community are agriculture and animal husbandry, with agriculture being the principal activity. The commune has 2,171 ha of paddy fields, with 1,808 ha under wet paddy. Only two hectares of this are irrigated in the dry season, by ponds and canals constructed by the commune with the help of the NGO PADEK). In 2005, there were 1,106 households rearing cattle and 1,095 households rearing pigs. The other main occupations are working as wage labour or in garment factories in Phnom Penh. The commune has 1,161 families with access to water, via piped and private pump wells.

**Figure 5: Location of study villages in Svay Rieng province**[14]




## 2.5. An overview of Sangkae commune

Sangkae commune is one of ten communes in Rumduol district, which is located in the centre of the province. The 2005 census data showed that there were 1,077 households comprising 4,763 people in the commune, among whom 671 people were illiterate. The main livelihoods are agriculture and animal husbandry. The commune has 2,210 ha under paddy, with 1,105 ha of wet paddy that is cultivated only in the rainy season. There were 961 households rearing cattle and 962 households rearing pigs. The other main occupations are working as wage labour, as taxi drivers, or as garment workers in Phnom Penh. There is no irrigation system anywhere in the commune and hence paddy cultivation is entirely rain-fed.

# 3. Disaster and climate-change vulnerability

## *3.1. Disaster vulnerability*

Cambodia is highly vulnerable to floods and droughts. However, the occurrence of these disasters has not been uniform over years or different geographical areas, or in terms of severity. Table 10 shows the number of water-related disasters recorded in Cambodia during 1987–2007.[15] The country is vulnerable primarily to floods, which constituted 67 per cent of all hydro-related disasters recorded in the 20-year period for which data are available, followed by droughts, which accounted for 28 per cent. However, during recent years, the occurrence of droughts in the Mekong region in general and in Cambodia in particular has caused concern, as this traditionally flood-vulnerable region has started to show signs of increasing vulnerability to drought. This study concentrates mainly on vulnerability to drought, taking a case-study approach to one of the country's most drought-prone provinces.

**Table 10: Water-related disasters in Cambodia, 1987–2007**

| Disaster type | Number | Percentage |
|---|---|---|
| Drought | 5 | 27.78 |
| Flood | 12 | 66.67 |
| Wind storm | 1 | 5.56 |
| **Total** | **18** | **100** |

Poverty and vulnerability to disaster are closely linked, and generally poor countries and poor communities are more severely affected by disasters than richer ones. Svay Rieng province is one of the poorest provinces in Cambodia. Food consumption in the province, one of the main poverty indicators, shows a large gap between local access to food and the national average. Households in Svay Rieng spend only $0.66 per day on food, while across the country the average is $0.81 per day. The World Food Programme's poverty index classifies the province as having 25–40 per cent of its population below the poverty line, and identifies one of its six districts as a high priority for poverty-reduction efforts.[16]

**Box 1: Poverty and disaster vulnerability in Svay Rieng** **According to the International Fund for Agricultural Development (IFAD), the following are factors contributing to poverty in Svay Rieng province that are also linked to its vulnerability to disasters:**

(a) Lack of access to sufficient productive resources, e.g. land and livestock, or alternative sources of employment, such as wage labour and off-farm income-generating activities;

(b) lack of access to improved technologies and reliance on enterprises showing low productivity and an absence of market-oriented production;

(c) lack of basic health services, low levels of literacy and numeracy, poor access to markets and input supplies, and lack of technical, financial, and marketing support services; and

(d) external shocks such as natural disasters, floods, and droughts, which can push people into poverty by destroying their productive assets.

(e) Source: IFAD (2003) 'Report and Recommendation of the President to the Executive Board'

## 3.2. Drought climatology

Drought is caused by a variety of factors in Cambodia. The country's geographical location makes it vulnerable to the Pacific Ocean El Niño phenomenon, during which years droughts are more common than floods.[17]

A look at past droughts helps us to better understand the drought vulnerability of the country. A good example is provided by the drought of 2002, which affected more than 1.5 million people in nine provinces (see Box 2).[18]

**Box 2: 2002 drought in Cambodia: a case study**

The drought of 2002 was considered to be one of the most severe in the country's history. According to official statistics, it led to only 35 per cent of the cultivable area being planted with rice, although this figure was reported subsequently to have risen to 50 per cent, as late rains brought some relief to eight drought-stricken provinces.

If seasonal rains arrive late, it has a serious impact on agricultural production and hence on the livelihoods of poor people in rural areas. On this occasion, rice planting was extremely late due to the lack of rain, and seedlings grown in the early part of the season were damaged or destroyed.

It was estimated that, of 1,609 communes, 31 per cent were unable to plant their rice crops. Normally up to 2m hectares of wet-season rice is planted in Cambodia, but by August 2002 only 700,000 hectares had been planted, according to the National Committee for Disaster Management. Despite the return of the monsoon rains in August, 333 communes in 62 districts of eight provinces (Takeo, Kompong Speu, Kandal, Kampong Cham, Svay Rieng, Oudar Meanchhey, Pursat, and Battambong) received insufficient rain for rice production. Damage to seedlings was reported across 20,502 hectares, while 47,788 hectares of transplanted rice were affected.

In Svay Rieng, drought seriously affected seedlings, resulting in stunted growth and/or withering. Seedlings that were ready could not be transplanted due to lack of sufficient water. Three districts – Kompong Ro, Romeas Haek, and Rumduol – were severely affected by the lack of rain. Of 180,000 hectares of land, only 50–60 per cent could be cultivated in 2002.

Source: Centre for International Disaster Information (2002)

The vulnerability of any region to drought can be assessed by using the Standard Precipitation Index (SPI). The SPI is the difference in precipitation from the mean for a specified time period, divided by the standard deviation, where the mean and standard deviation are determined from past records. However, as the precipitation will not be distributed normally over the timescale considered, a transformation is applied to the distribution. Hence, the SPI is simply the transformation of the precipitation time series into a standardised normal distribution .[19]

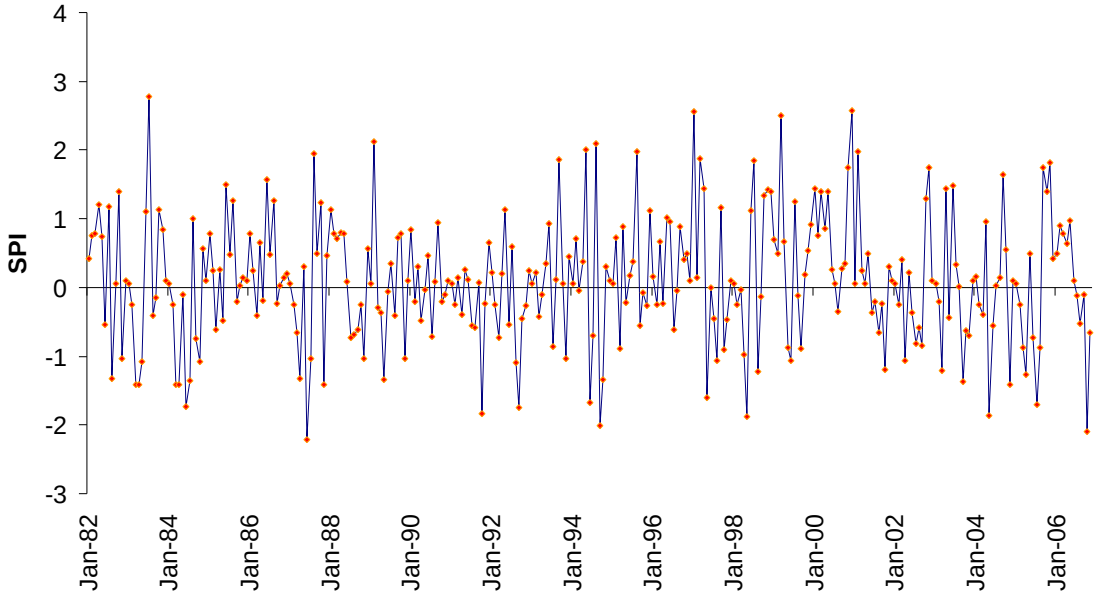
Rainfall data obtained from Svay Rieng province were subjected to SPI analysis, and the results are presented in Figure 6. This indicates large deviations in rainfall patterns over the study period. Of 282 rainfall events (monthly rainfall data) recorded, 126 events, or 42 per cent, were negative (less than normal), and 172 were greater than normal. The team counted numbers of consecutive negative months between January 1982 and November 2006. Six consecutive negative SPI values occurred during the 50-month period from January 1982 to January 1986, followed by five consecutive negative SPI values during May 1998–May 2002. The fewest consecutive negative SPI values (three) were recorded in April 1994–April 1998. During the study period, a maximum SPI value of 2.78 and a minimum SPI value of -2.21 were recorded. In 2002, the drought year in Cambodia, six negative SPI months were recorded. The months of June, July, August, and

September, normally the months of the south-west monsoon, recorded negative SPI values, while the revival of the monsoon in October and November was indicated by positive SPI values.

Rainfall behaviour in Svay Rieng province is erratic, with detrimentally long dry spells spanning six months at times. This means there is a real need for dependable irrigation, water harvesting, and storage systems so that crop production is not severely hampered due to scarcity of water. However, at the same time, the highest SPI value of 2.78 indicates a possibility of floods.

It is necessary to identify a threshold SPI value in order to pinpoint impending drought. For this, a detailed study needs to be conducted of associated impacts from all sectors, and these need to be correlated with the SPI value of each month. Since SPI values reflect only rainfall and not existing water availability in reservoirs and canal systems, such a detailed impact assessment study should also compare the duration of negative SPI values with that of reductions in the water available from various sources, including groundwater, reservoirs, and canal irrigation systems.

**Figure 6: Standardised Precipitation Index of rainfall events in Svay Rieng province, 1982–2006**




In addition to the rainfall situation, analysis of existing irrigation systems in the province indicated that the majority of them are old and that their capacity is low (see Table 11). Although there are plans to expand the coverage of these irrigation systems in future, progress has been slow, due to the lack of sufficient funds and the absence of state support. It is interesting to note that the data in Table 11 corroborate the responses of communities, who ranked the shortage of irrigation facilities as a reason for their vulnerability to drought (see Section 4 on drought impacts).

**Figure 7: SPI values in 2002. Negative SPI values during June–September indicate drought.**

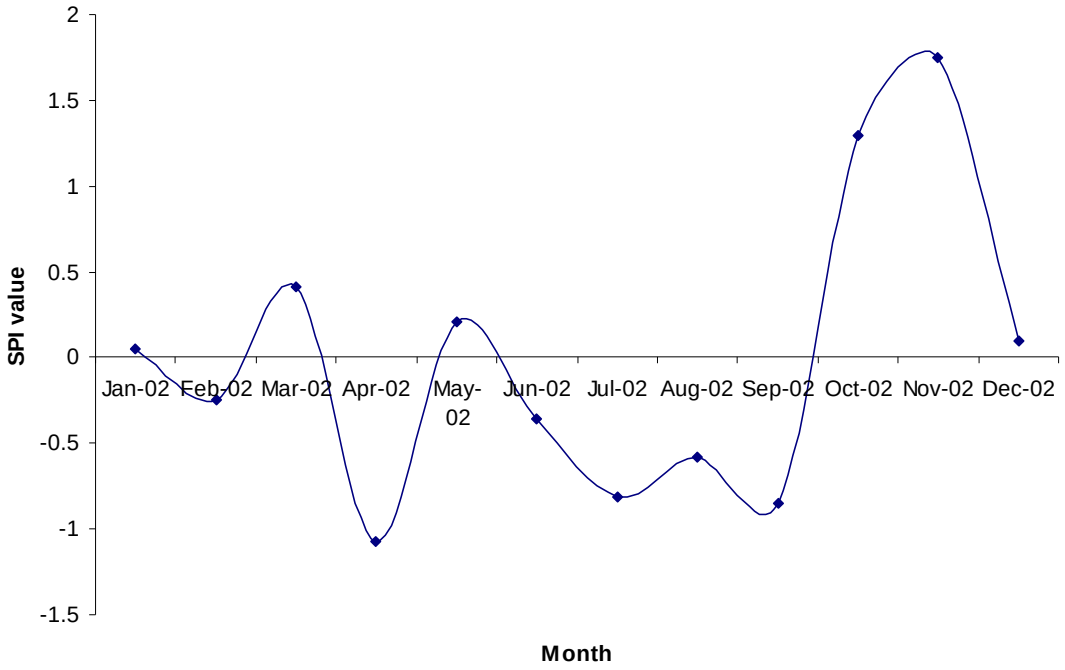



**Table 11: Irrigation projects in Svay Rieng province**[20]

| Type of project | Location | | | Capacity (present) | | Area of cover in future | | Remark |
|---|---|---|---|---|---|---|---|---|
| | District | Commune | Village | Dry season (ha ) | Rainy season (ha) | Dry season (ha ) | Rainy season (ha) | |
| Dam, Kampong Chrey | Svay Chrom | Svay Thom | Svay Cheak | 400 | 0 | 1,744 | 1,275 | Old |
| Canal system, Kraing Leav | Svay Chrom | Svay Thom | Kraing Leav | 431 | 600 | 940 | 600 | Repaired |
| Canal, Krosang Chrom | Svay Chrom | Krous | Krosang Chrom | 300 | 0 | 565 | 0 | Old |
| Canal, Hun Sen Tanou | Svay Chrom | Chambak | Tanou | 600 | 300 | 600 | 600 | Repaired |
| Canal, Samrong | Svay Chrom | Chambak | Tanou | 185 | 0 | 185 | 0 | Old |
| Canal, Cheas Russey | Svay Chrom | Kampong Chamlong | Cheas Russey | 430 | 0 | 700 | 600 | Repaired |
| Dam, O-Smach | Svay Chrom | Kampong Chamlong | Russey Prey | 150 | 800 | 600 | 1,200 | Repaired |
| Canal system, Kampong Chamlong | Svay Chrom | Kampong Chamlong | Ta Sa Ang | 370 | 0 | 370 | 0 | Part-repaired |
| Canal system, | Svay Chrom | Krol Ko | Beoung Vay | 100 | 3,604 | 2,604 | 3,604 | Repaired |

| Type of project | Location | | | Capacity (present) | | Area of cover in future | | Remark |
|---|---|---|---|---|---|---|---|---|
| | District | Commune | Village | Dry season (ha ) | Rainy season (ha) | Dry season (ha ) | Rainy season (ha) | |
| Koun Plous | | | | | | | | |
| Spillway, Doun Sar | Svay Chrom | Thlok | Doun Toung | 800 | 3,000 | 800 | 3,000 | Repaired |
| Channel, Neal | Svay Chrom | Basak | Bayarb | 1,330 | 0 | 4,000 | 0 | Old |
| Spillway, Vayko | Svay Rieng | Pour Tahor | Khbal Thnol | 2,100 | 7,126 | 4,000 | 7,126 | Repaired |
| Canal system, Chup Pring | Kampong Rou | Thmey | Chup Pring | 1,700 | 0 | 1,700 | 0 | Repaired |
| Hun Sen Sopha station | Kampong Rou | Bantey Kraing | Keo Chech | 350 | 0 | 350 | 0 | Repaired |
| Channel, O-doumrey chhlong | Kampong Rou | Bantey Kraing | Pour Krouch | 1,000 | 0 | 1,600 | 0 | Old |
| Dam, Kampong Rotes | Kampong Rou | Reach Montie | Phnom Srouv | 70 | 0 | 285 | 785 | Repaired |
| Channel, Rou | Kampong Rou | Ghour | Svay Annath | 400 | 0 | 461 | 0 | Old |
| Dam, Doun Tey | Chantrea | Chreas | Banla Shit | 25 | 250 | 800 | 1,000 | Old |
| Creek, Kambot | Chantrea | Chreas | Tropaing Thlok | 34 | 0 | 50 | 300 | Old |
| Dam, Svay Year | Chantrea | Samrong | Cheak | 92 | 0 | 250 | 0 | Part-repaired |
| Dam, Patou | Chantrea | Toul Sday | Toul Dday | 188 | 0 | 300 | 0 | Part-repaired |
| Chantrea | Chantrea | Chantrea | Chantrea | 400 | 0 | 400 | 0 | Old |
| Channel, Romeat | Romeas Haek | Chrey Thom | Romeat | 52 | 0 | 52 | 0 | Old |
| Ompil | Romeas Haek | Ompil | Tropaing Poupeal | 160 | 0 | 160 | 0 | Old |
| Veal Crous | Romeas Haek | Koki | Prey Khdey | 110 | 0 | 110 | 0 | Old |
| Takoup | Romeas Haek | Kampong Trach | Takoup | 200 | 0 | 200 | 0 | Old |
| Channel, Battras | Romeas Haek | Doung | Kampong Thna | 116 | 0 | 116 | 0 | Old |

### 3.2.1. Floods

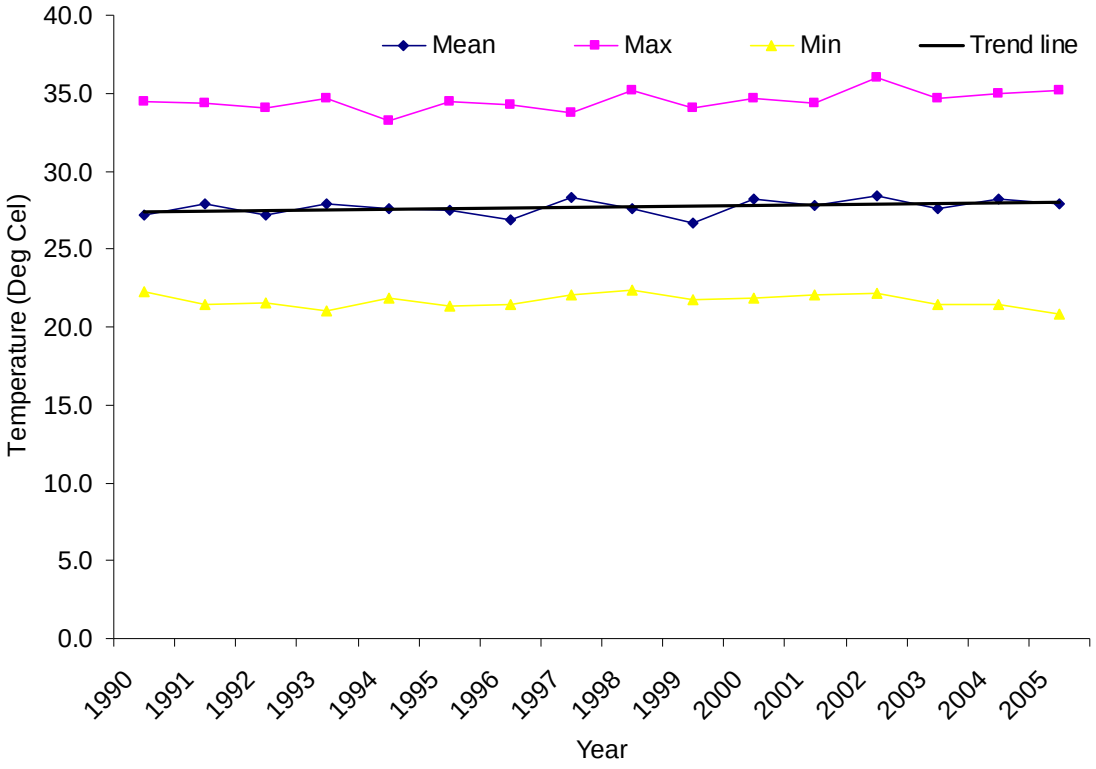
Svay Rieng is also vulnerable to floods. The flooding in 2000–01 was considered to be the most serious during recent years: 16 provinces suffered severe damage as a result of heavy rainfall that caused the Mekong and Tonle Sap rivers to overflow.[21] Recurrent floods and droughts have been identified as one of the reasons for the high levels of absolute poverty in the region.[22]

## *3.3. Climate-change vulnerability*

Cambodia is highly vulnerable to climate change, due to the large proportion of its population dependent on climate-sensitive livelihood sectors such as agriculture, animal husbandry, and

fishing.[23] The two most important indicators of climate change from which impacts can be identified are temperature and rainfall trends. Climate-change studies require long-term climatic data spanning more than 50 years. However, since such data is not available in Cambodia (see Box 8: Drought monitoring and forecasting in Cambodia), it has been very difficult to ascertain climate-change impacts in the country. The available data, plotted over years, indicated no discernable trends (see Figures 8 and 9).

**Figure 8: Long-term mean, maximum, and minimum temperatures recorded at meteorological station in Svay Rieng province. The black solid line indicates the linear trend.**

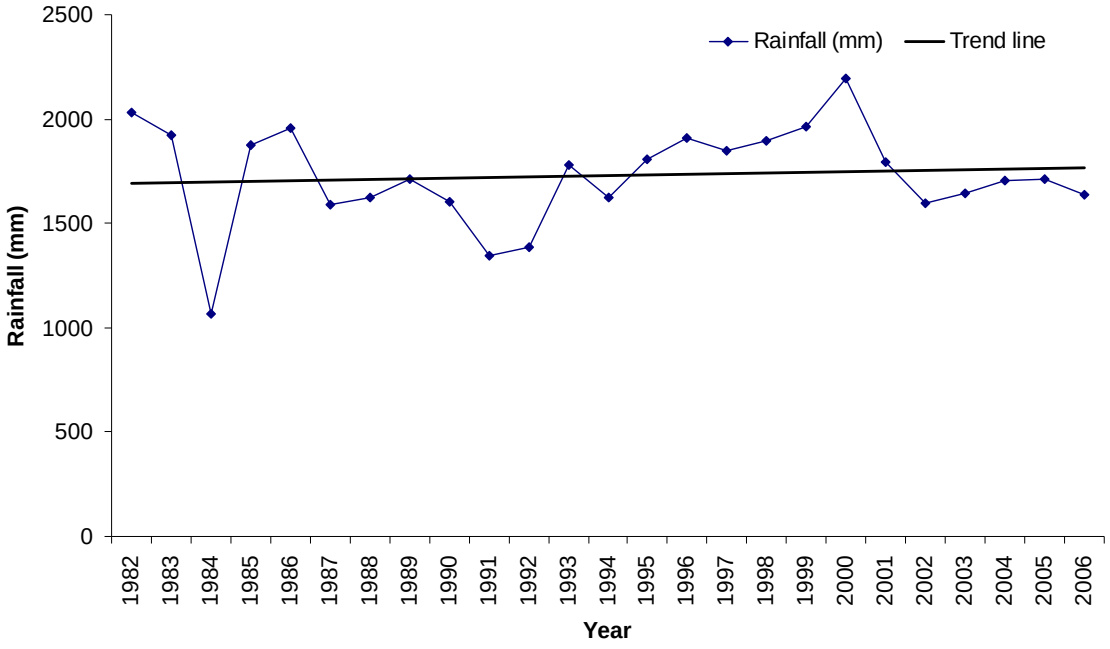



However, a 2001 report by the Cambodian Ministry of Environment, 'Vulnerability and Adaptation Assessment to Climate Change in Cambodia', an outcome of the ministry's Climate Change Enabling Activity Project in collaboration with UNDP/GEF, highlighted the following possible impacts:[24]

- Temperatures in Cambodia could rise by up to 2.0°C (under one scenario) or 2.5°C (under another scenario).
- Rainfall is expected to increase from its current levels. However, the future regional distribution of rainfall cannot be assessed with much precision. By 2100, rainfall in the country could increase by between 3 per cent and 35 per cent, depending on the location. Low-lying areas will be impacted more than areas of higher ground.
- Floods and droughts in Cambodia are not always directly related to the El Niño-Southern Oscillation (ENSO) phenomenon. Flooding is more closely related to water levels in the Mekong River, and so rainfall in the wider Mekong region plays a more important role than rainfall in Cambodia alone.

- Rainfall in the month of May was found to be closely correlated with the yield performance of wet-season rice. The yield of wet-season rice was projected to increase, while dry-season rice may increase or there may be no change.
- The area covered by wet forests would decrease with a changing climate and the area under moist and dry forests would increase.
- Simulations modelling a one-metre rise in sea levels indicated that 0.4 per cent of Cambodia's coastal land would be lost.

**Figure 9: Long-term rainfall in Svay Rieng province. The black solid line indicates the linear trend.**



# 4. Perceptions of disasters and climate change

This section presents the results of questionnaire surveys and focus group discussions (FGDs) conducted with communities and government officials. Gender-disaggregated data are presented only for community responses. Information obtained from government officials is presented in the boxes distributed throughout this section.

## *4.1. Disaster profile*

The results from eight FGDs showed that drought is the most prevalent type of disaster in the region. During discussions, the focus was on trends in drought prevalence, its impact, and strategies to cope with it. Droughts occurred in 2002 and continued up to 2006. All participants agreed that droughts have been getting more severe during recent years.

**Box 3: Definition of drought**

A practical definition of drought helps in identifying the phenomenon and in initiating timely and effective responses. Such a definition needs to be established at various geographical levels, including village, commune, district, and national levels. Our interactions with local-level government machinery suggested that no common definition of drought has been identified by the government. The only definition of drought that government officers could provide was 'lack of sufficient water' or 'lack of sufficient rainfall' for paddy cultivation. Hence, it is imperative that a comprehensive definition of drought is established in Cambodia before credible drought preparedness and response mechanisms can be initiated.

Respondents could not quantify changes in rainfall, but they could identify changes in rainfall patterns. They agreed that the start of the rainy season is increasingly being delayed and that the dry season has become longer in recent years. In a normal year, the rainy season begins in May, but in a drought year it may be delayed until September or even later.

### 4.1.1. Impacts of drought

Before identifying drought impacts, efforts were made to identify real problems in the community by means of a problem-ranking exercise. In this exercise, groups of both female and male participants in communities were asked to identify all the problems in their village and to rank them, in a participatory manner. Table 12 lists the problems as ranked by each village.

**Table 12: Ranking problems by communities**

| Romeas Haek district/Andoung Pou commune | | Rumduol district/Sangkae commune | |
|---|---|---|---|
| **Thmei village** | **Roung Snao village** | **Ta Naeng village** | **Kouk Srama village** |
| 1. No power supply | 1. Lack of food | 1. Lack of food | 1. Lack of food |
| 2. Lack of food | 2. No power supply | 2. No power supply | 2. No power supply |
| 3. Bad fields | 3. Bad fields | 3. Bad fields | 3. Bad fields |
| 4. No irrigated fields | 4. Lack of new seeds | 4. Poor irrigation system | 4. Lack of new seeds |
| 5. Lack of information on disaster preparedness | 5. Poor irrigation systems | 5. Lack of new seeds | 5. Poor irrigation systems |
| 6. Lack of seeds | 6. Lack of livelihood | 6. Lack of seeds | 6. Lack of livelihood |
| 7. Old seeds | 7. Lack of fertiliser | 7. Lack of livelihood | 7. Lack of fertiliser |
| 8. Lack of fodder | 8. Lack of practical knowledge and techniques | 8. Lack of fertiliser | 8. Lack of practical knowledge and techniques |
| 9. Lack of insecticide | 9. No mass communications | 9. Lack of practical knowledge and techniques | 9. No mass communications |
| 10. Lack of fertiliser | 10. Lack of early | 10. No markets for animal husbandry | 10. Lack of early |
| 11. Lack of clean water | | | |
| 12. Lack of health | | | |

| Romeas Haek district/Andoung Pou commune | | Rumduol district/Sangkae commune | |
|---|---|---|---|
| facilities<br>13. Lack of education facilities<br>14. Lack of practical knowledge and techniques | warning system<br>11. Lack of insecticide<br>12. No pump machine<br>13. Far from water source | 11. Lack of water in dry season<br>12. Lack of fodder<br>13. No mass communications<br>14. Lack of early warning system<br>15. Lack of insecticide<br>16. No fuel to run pump machinery | warning system<br>11. Lack of insecticide<br>12. Lack of technical knowledge<br>13. Lack of pump machine<br>14. No fuel to run pump machinery<br>15. No markets for animal husbandry<br>16. Lack of education and heath facilities |

**Note:** *Composite information from groups consisting of both females and males. It was not easy to identify the perceptions of individual participants in each FGD, consisting of both males and females, because they tended to all agree with the first answer given by someone in the group.*

In general, participants believed the lack of food to be the most significant problem in their village, followed by the lack of power supply, bad fields (low productivity or low fertility), lack of new seeds (high-yielding varieties that are tolerant to drought and pests), and lack of irrigation facilities.

After identifying significant problems, we asked groups why they thought they were problems. The response was that, since drought is a significantly debilitating event in their lives, the lack of fertile land, irrigation facilities, and better seeds makes them vulnerable to drought. Information from the eight FGDs also showed that the impacts of drought were similar for all community members in both communes, due to the similarity of natural and socio-economic conditions. Agriculture and animal husbandry are important community livelihood activities in Svay Rieng province and are also the most vulnerable to drought.

## Impacts of drought on different genders and age groups

We made efforts to identify the differential impacts of drought on women and men. Both men and women believed that men are more affected by drought than women. When asked why they felt this, participants explained that men have to work under harsh conditions (hot temperatures, in the fields, many hours per day) or may lose their jobs and have to migrate to towns to find work.

**Table 13: Impacts of drought as identified in FGDs**

| Romeas Haek district | Rumduol district |
|---|---|
| • Loss of biodiversity<br>• Damage to crops<br>• Decreased air quality due to dust and pollutants<br>• Delay in field operations<br>• Disputes within and between families<br>• Disease<br>• Children dropping out of school<br>• Exhausted fields<br>• Loss of forests<br>• Headache due to high temperature<br>• High mortality of livestock<br>• Unemployment<br>• Loss of income<br>• Increased conflicts over water use (conflict between different communities)<br>• Pest infestation of livestock<br>• Insect pests on crops<br>• Lack of fodder<br>• Lack of seeds<br>• Lack of water<br>• Low-quality produce/crops<br>• Low yields and productivity<br>• Lower water levels in reservoirs, lakes, and ponds<br>• Migration<br>• Reduction in nutrition (both child and adult)<br>• Stress due to exhaustion<br>• No cultivation in some seasons | • Loss of biodiversity<br>• Damage to crops<br>• Disputes in the community<br>• Diseases such as diarrhoea, typhoid fever<br>• Children dropping out of school<br>• Loss of field productivity<br>• Forced sale of livestock<br>• Fatigue due to high temperatures<br>• High mortality of livestock<br>• Unemployment<br>• Loss of income from crops and livestock<br>• Insect pests on crops and livestock<br>• Lack of fodder<br>• Lack of seeds<br>• Lack of water<br>• Low-quality produce<br>• Low yields and productivity<br>• Migration<br>• Poor germination<br>• Reduction in nutrition<br>• Stress<br>• Women remaining spinsters |

***Note:*** *Ranked and grouped impacts are presented in Section 5 on Policy options.*

Since all respondents answered that men were more affected than women, we tried to identify whether this was in fact the case by asking further questions related to the roles of men and women in each family. From the results, we found that women bear nearly 60 per cent of the total workload while men bear only 40 per cent (a figure derived from the average of each column in Table 14).

**Table 14: Responsibility of men and women for daily tasks**

| Task | Percentage (%) of responsibility | |
|---|---|---|
| | Men | Women |
| Cooking | 15 | 85 |
| Buying food | 10 | 90 |
| Taking care of children and sick people | 10 | 90 |
| Washing clothes | 5 | 95 |
| Rearing animals | 30 | 70 |
| Selling own labour | 70 | 30 |
| Collecting water | 30 | 70 |
| Preparing soil for cultivation | 50 | 50 |
| Planting crops | 50 | 50 |
| Harvesting crops | 50 | 50 |
| Controlling insect pests | 70 | 30 |
| Decision-making | 60 | 40 |
| Responsibility for household income | 90 | 10 |
| Public contribution and policy making | 5 | 95 |
| Firewood collection | 60 | 40 |

We also found that the impacts of drought were actually greater on women than on men. Men are responsible for earning income for the household, while women – in addition to their farming activities – carry out almost all of the essential domestic tasks such as cooking, buying food, washing clothes, and taking care of children and sick members of the family. These take considerable time and drudgery. In a drought year particularly, the stress is increased further as women have to fetch drinking water. Men and women share agricultural work.

It was hard to judge the degree of awareness of the importance of gender among local authorities in drought response. Government officials interviewed (see Box 11) showed gender awareness that they said was reflected in their recruitment, and in specific responses. However, it is open to question whether the scale of recruitment – there are large numbers of female teachers and health workers in the area – or the types of response, are really adequate to meet the needs of women and girls. Response seems heavily geared towards medicines and other health-related interventions, rather than, say, water or fodder.

There is no doubt that drought affects all those living in affected areas, but the impacts are worse on women due to their socio-cultural and economic status within the family and the community. In times of drought, women's workloads increase sharply due to the scarcity of water, the loss of male employment in the agricultural sector and their subsequent migration to cities in search of work, and the ill health of family members and livestock.


**'The land became exhausted and the price of fertilisers is increasing. My husband had to move to Phnom Penh to work on a construction site, and it is the only income we have.'**

*Mor Sun, Roung Snao village, Andong Pou commune, Romeas Haek*

**Plate 3: Land is left fallow mostly due to drought and poor fertility**

The focus group discussions also revealed that, because water sources have not been replenished by the sparse rainfall over the past three to four years, people have to wait much longer to collect water from wells. Women and children in particular spend many hours daily collecting water. Additionally, many women have become the acting heads of their households. In 2005, no crops were cultivated due to the lack of rainfall. Men left their homes in search of work, some migrating to large cities such as Phnom Penh, while many others went to nearby villages where work was available.

In Rumduol district, women are able to earn some income by collecting scrap iron and working as small traders. In Andoung Pou commune in Romeas Haek district, most women go to the forest to cut trees; by selling wood, they can earn 4,000 riel ($1) a day. Women are spending a lot more time on these activities now to make up for the income lost from farming. Income earned by women from collecting scrap iron, small trading, and cutting trees seems to be the primary source of cash for most of the households in the drought-affected areas in both Romeas Haek and Rumduol districts. However, not all these options are easily available. Opening up a small shop

requires capital that many households do not have. Banks will not lend them money, due to their lack of assets to serve as security. Drought-relief efforts undertaken by governments and NGOs have been of a temporary nature and do not help for long, nor do they generate useful community assets that could be used in times of drought.

When asked about the groups most vulnerable to the impact of drought, all participants agreed that women, children, and elderly people tend to get sick easily and so are highly vulnerable. Participants reported that women's health was worse affected due to their reproductive roles and subordinate position in the family. Women are always the last to eat and have the least to eat. Prolonged malnutrition and increasing workloads have adverse effects on women's health in general and on pregnant women and lactating mothers in particular.

**Box 4: Debt and school drop-outs due to drought**

Debt is a growing problem for villagers in Svay Rieng province. According to participants in eight focus group discussions and in-depth interviews, about 80 per cent of households are in debt to banks and other money-lenders.

At least 85 households who participated in the FGDs had borrowed at some point in a given year, and more during a drought year. They often borrowed from village money-lenders, relatives, NGOs, and from village rice banks.

While some were able to repay their loans, others found themselves constantly in debt for part or all of the year. Paying off a year's debts left farmers no better off, as they had to borrow again to buy food and seed for subsequent years, as their income was not sufficient to sustain income-generating activities.

Some villagers had lost their land because of debt, the interviewees reported. 'Aside from family, the rice bank appears to be the least predatory form of lending', a villager said. 'However, the "capital" of the bank has been destroyed by recurring drought. Farmers who had borrowed were unable to repay their loans, so it had no rice left to lend.'

School drop-out is a significant problem. Most students reach year nine at school and then stop. In 2006, 100 students sat the end-of-school exams but only 20 per cent passed. No students from the villages in the study area have gone to Phnom Penh to continue their studies.

Women also suffer more psychologically, due to their lack of control over the situation and their need to maintain their traditional role of managing the family with a reduced income. Women are often perceived to have a low status in Cambodian society. On one hand, girls are often considered a burden on the family and are married off early; on the other, women who migrate to the cities in search of work have fewer chances to get married and so miss their chance, remaining spinsters. Women in this region often work in garment factories located in big cities.

All the participants in the FGDs agreed that drought had pushed them into debt. Low productivity and barren land are among the reasons why they have to go to the cities in search of jobs. 'Drought is also a cause of migration', said the village head of Ta Naeng.

**Box 5: Problems in Thmei village (Andoung Pou commune, Romeas Haek district)**

Thmei is a village of 175 households, with a total population of more than 900 people. The commune chief, who spoke to the interviewers, said that the most pressing problem in the commune was the lack of water for agriculture. Of the commune's funding proposals, the number one priority has been constructing a 4km canal system; the second priority was to install a pump. However, said the commune chief, there had been conflicts over using the pump because it was too costly, as villagers had to save fuel for lighting every night. The commune chief had earlier contacted PADEK, which had provided wells for other villages in the area, but the NGO had not been able to help. Thmei village has five privately dug wells; these cost about R400,000 each to dig, while a pump costs R300,000 ($1 = R4,000).

'Of Thmei's 175 families, about 15 per cent are in trouble, but they can survive', he says. Many people help poor or struggling families, for example by helping with transplanting rice for free or by providing opportunities for needy families to secure paid work in preference to others. In each of the previous two years, at least two families have left the village. People sometimes leave to escape debt, but the bigger problem, according to the chief, is that there are no jobs in the village. He thinks that more families will leave in search of work. The jobs and locations of choice are Phnom Penh, to work in construction or, if people can finance it, Poipet, because there is land available there. Poipet is the better option, according to people who have returned from there, because you can survive even if you are not rich. Fewer than 20 women have gone to Phnom Penh to become garment workers.

The commune chief's is one of ten families in the village that have borrowed new rice seed from the NGO Catholic Relief Services (CRS). Thmei has a rice bank, which was initially established by the Cambodian community-based organisation Santi Sena with three tonnes of rice. If a family borrows 10kg of rice, it has to repay 14kg after the harvest. All the rice has now been loaned out and, because of drought, farmers are unable to repay, so repayment has been held over until the next harvest. Apart from private money-lenders, the only credit source in the village is Santi Sena. The chief says that four village families who owed money to Santi Sena and to money-lenders lost their land and left the village as they could not repay their loans.

## *4.2. Vulnerability to drought*

Vulnerability to drought is a complex issue. It varies from location to location and across the socio-economic profile of communities. Respondents believed that farmers are the group of people most vulnerable to drought. Some respondents also believed that people employed in jobs are also vulnerable to drought; this could be due to the impact on the agricultural sector rippling out more widely to affect other rural sectors. Community members also believed that higher-lying areas are the most vulnerable to drought, that field crops are more vulnerable than orchard or plantation crops, and that rainfall is the most vulnerable water source, followed by groundwater and canal water. However, many also believed that all water sources are equally vulnerable to drought. No significant differences were observed between the genders.

**Box 6: Problems in Ta Naeng village, Sangkae, Rumduol district**

Ta Naeng is a village of 201 households and more than 1,000 people. Because of shortfalls in rice production, many villagers have to find additional sources of income. Chan Saveoun, a 55-year-old woman, lives with her daughter, the daughter's husband, and their two children. She has a son who works in an ice factory in Phnom Penh. Chan Saveoun has 1.5 hectares of land planted to rice. If the weather is good, she can get a yield of 30–40 *thang* (1 *thang* = 20kg). Chan Saveoun says she has never had to use pesticides in her field. However, each year she applies two sacks of DAP fertiliser, which costs R49,000 per bag. She says, 'We have had to use more and more fertiliser every year just to get the same harvest; the soil is poor'.

A good harvest can feed the family for five or six months. After that, they have to find other sources of income to buy food. The three adult members of the household work in the village, transplanting rice, digging, and working as porters. If they dig earth, they get R2,000 per cubic metre; transplanting rice pays R2,500 a day plus meals.

Other families in the same situation collect wild foods from the fields and fish to feed themselves daily. The rising price of rice is a problem. In 2000 it was R5,000 a *tao* (1 *tao* = 15kg), in 2001 more than R10,000, and in 2006 it was R15,000. For poor people, this makes life very difficult.

**Table 15: Vulnerability factors as reported by respondents**

| Respondents/factors | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| 1. Farmers | 92 | 96 | 90 | 92 |
| 2. Artisans | 0 | 1 | 2 | 1 |
| 3. Job holders | 8 | 1 | 0 | 1 |
| 4. Others | 0 | 2 | 8 | 5 |
| | | | | |
| 1. Low-lying areas | 0 | 2 | 16 | 14 |
| 2. High areas | 32 | 33 | 36 | 39 |
| 3. All | 68 | 65 | 48 | 47 |
| | | | | |
| 1. Field crops | 36 | 51 | 40 | 52 |
| 2. Orchards | 0 | 1 | 3 | 1 |
| 3. Plantation crops | 0 | 0 | 7 | 2 |
| 4. All | 64 | 48 | 51 | 45 |
| | | | | |
| 1. Canal water | 3 | 1 | 5 | 5 |
| 2. Groundwater | 10 | 20 | 14 | 19 |
| 3. Rainfall | 37 | 40 | 32 | 30 |
| 4. All | 50 | 39 | 49 | 46 |

Almost all the respondents (100 per cent in Romeas Haek and 96 per cent in Rumduol) believed that their vulnerability to drought has been increasing over the years. Increasing vulnerability, they said, was due mostly to the degradation of natural forests and to the reduction in rainfall. Responses were similar from both genders.

**Box 7: Drought and the poverty cycle**

Pheouk Sary, 48, is a farmer who is hampered by a shortage of water. He has four hectares of land, but does not cultivate it all because there is not enough water. He gets a maximum yield of 100 *thang* of rice, which is enough to feed him, his wife, and the three of their six children who still live with them for only six or seven months per year. In 2006, he was not allowed to borrow from the rice bank because he still owed it five *thang* plus interest on his previous loan. He also raises chickens and a pig. Pheouk Sary would like to see all of his children attend school, including the girls, but he says that 'if times are hard, the boy will be preferred' for schooling.

**Table 16: Reasons for increasing drought vulnerability**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| **Reason** | **Male** | **Female** | **Male** | **Female** |
| 1. Degrading natural forests | 67 | 62 | 66 | 70 |
| 2. Decreasing rainfall over the years | 33 | 36 | 25 | 24 |
| 3. Lack of alternative employment | 0 | 1 | 2 | 1 |
| 4. Lack of dependable irrigation facilities | 0 | 0 | 3 | 1 |
| 5. Lack of suitable crops and cropping practices | 0 | 0 | 0 | 2 |
| 6. Lack of drought-tolerant animal breeds | 0 | 0 | 3 | 1 |
| 7. Cannot say | 0 | 1 | 2 | 1 |

Community members were asked about the diversity of livelihoods available, since diversity helps to buffer the impact of drought. From the opinions expressed, it emerged that livelihood options are relatively better developed in Rumduol than in Romeas Haek. Interestingly, more female respondents than male in both locations believed that livelihood options were 'most diverse'. Fewer female respondents in Romeas Haek, however, believed that livelihood options were average or above average, compared with Rumduol.

**Table 17: Diversity of livelihood options**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| **Livelihood options** | **Male** | **Female** | **Male** | **Female** |
| Most diverse | 0 | 5 | 10 | 14 |
| Above average | 14 | 10 | 19 | 24 |
| Average | 50 | 40 | 27 | 24 |
| Below average | 33 | 34 | 31 | 23 |
| Poor | 3 | 11 | 13 | 15 |

## *4.3. Disaster management*

Communities were asked about disaster management systems in use in their location. Questions focused more on early warning and preparedness mechanisms, as these enable communities to be prepared and help in reducing the impact of recurring disasters. Early warning is also important in a changed climate scenario, due to the uncertainty involved in long-term trends of disasters. Community members also gave feedback on who provides early warning, the means for early warning, and whether or not early warning has been timely.

Eighty-eight per cent of respondents in Romeas Haek said there was no early warning system at all, while 83 per cent of respondents in Rumduol felt the same. However, more respondents, and especially female respondents in both locations, felt that more early warning came from community leaders than through any other channel. Of those who felt that early warning was available, the main source was radio, followed by television. Neighbours also played an important role in disseminating early warnings.

**Table 18: Options and effectiveness of early warning**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| **Early warning options** | **Male** | **Female** | **Male** | **Female** |
| **Source** | | | | |
| 1. No early warning | 98 | 78 | 85 | 81 |
| 2. Community leaders | 2 | 20 | 7 | 14 |
| 3. Provincial leaders | 0 | 0 | 0 | 0 |
| 4. Central government | 0 | 0 | 5 | 3 |
| 5. Local agricultural department | 0 | 0 | 2 | 0 |
| 6. Local meteorological department | 0 | 2 | 2 | 1 |
| **Dissemination** | | | | |
| 1. Television | 12 | 17 | 7 | 6 |
| 2. Radio | 28 | 24 | 28 | 20 |
| 3. Neighbours | 2 | 8 | 0 | 6 |
| 4. Loudspeaker announcement | 0 | 1 | 0 | 0 |
| 5. Community centre | 0 | 0 | 0 | 0 |
| 6. Cannot say | 57 | 49 | 65 | 68 |
| **Quality of early warning** | | | | |
| 1. Timely | 34 | 19 | 12 | 15 |
| 2. Not timely | 66 | 81 | 88 | 85 |
| 1. Adequate information | 25 | 19 | 0 | 5 |
| 2. Inadequate information | 75 | 81 | 100 | 95 |
| 1. Helps in preparedness | 0 | 8 | 0 | 0 |
| 2. Does not help in preparedness | 100 | 92 | 100 | 100 |

An early warning needs to be timely in order to be effective. Timely warnings help with quick, last-minute planning for effective and precise responses, both by communities and by local authorities and NGOs. Questions were also asked about the timeliness of early warnings. It is to be noted that in Table 18 the percentages given are the responses of those who thought that early warning systems existed. More respondents thought that early warning systems lacked timeliness and did not give adequate information, and so were not useful in disaster preparedness. This opinion was stronger among women in Romeas Haek than in Rumduol.

When it came to personal involvement, 86 per cent of community members believed that they personally had no role to play in the dissemination of early warnings. Among those who thought they did have a role to play, 13 per cent thought that their most important role lay in identifying vulnerable households or groups who should be informed first. However, the majority of respondents, 79 per cent, were not aware of any role that they could play in disseminating early warnings.

**Box 8: Drought monitoring and forecasting in Cambodia**

Drought monitoring and forecasting involve continuous observation of the rainfall situation, checking the water needs of different sectors such as agricultural, housing, industrial etc., and deciding whether or not the water available from various sources is sufficient for these sectors. The Department of Meteorology, under the Ministry of Water Resource and Meteorology, is responsible for monitoring rainfall in Cambodia through its National Meteorological Centre in Phnom Penh. An assessment carried out by the United Nations International Strategy for Disaster Reduction (UNISDR) revealed that Cambodia's meteorological network had been almost completely destroyed by the internal conflict and so was not in a position to provide the forecasting services necessary for disaster risk reduction, including for floods and drought. The assessment also pointed to the need to enhance the observation network and data-processing capacity and facilities in the country. Efforts have been initiated to strengthen Cambodia's meteorological observation system, with the aid of the Japan International Cooperation Agency and the World Meteorological Organisation, under a project entitled 'Development of Cambodia and Lao P.D.R.'S Tropical Cyclone Forecast and Early Warning Service'.

Source: UNISDR (2006) Development of Cambodia and Lao P.D.R.'s Tropical Cyclone Forecast and Early Warning Service. http://unisdr.unbonn.org/ewpp/project_viewer.php?project_id=78

Declaring a drought is another important administrative procedure that affects the timeliness of responses. 'Declaration' means that a location affected by drought qualifies to be called 'drought-affected', although Cambodia does not have a clear official definition of drought. However, the government often responds after observing impacts such as widespread loss of crops, migration, and food shortages. Since the government and other organisations are continuously monitoring agricultural and other situations, not necessarily as part of a drought-monitoring exercise, indicators such as crop losses help them in declaring areas to be drought-affected and in diverting relief efforts to the affected population. Since early declaration is important for the effective diversion of relief efforts, our questions were focused on how quickly the government declared an area to be drought-affected.

**Table 19: Timeliness of drought declaration**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| **Drought declaration** | **Male** | **Female** | **Male** | **Female** |
| 1. Immediately after the disaster | 21 | 21 | 7 | 10 |
| 2. Within one week | 5 | 5 | 3 | 3 |
| 3. After one week | 2 | 1 | 0 | 1 |
| 4. After two weeks | 0 | 3 | 2 | 2 |
| 5. After three weeks | 2 | 5 | 2 | 1 |
| 6. More than three weeks | 0 | 1 | 3 | 3 |
| 7. Not known | 70 | 64 | 83 | 79 |

The majority of respondents were not aware of the drought declaration process and so they could not rate whether it was timely or not. However, among those who did know about it (a much higher percentage in Romeas Haek than in Rumduol), most thought that the declaration happened immediately after the onset of drought or within one week. This is surprising, since drought is a slow-onset, creeping disaster and it is often difficult to state exactly when drought 'occurs'. However, from the responses, it could be discerned that the government acted relatively quickly within a reasonable time of identifying symptoms of drought.

**Box 9: Issues in drought forecasting**

The following points arose from interviews with government officers and indicate their opinions on existing drought-forecasting mechanisms in the country.

- Most government officers believed that drought forecasting is late and hence is either partially relevant or not relevant for making timely interventions.
- Though they thought that sufficient human resources are available, the opinion of the officers was divided on the existing technical capability within the government to collect and analyse meteorological information to produce a useful drought forecast.
- It was not clear what determines government's first responses to drought. It appears that an outcry by affected people, by NGOs, and by the media always precedes the government response, a fact that highlights gaps in the existing drought preparedness and response system.

The actual drought response starts subsequent to a declaration of drought, although sometimes responses start much earlier, mostly initiated by local-level NGOs and other small actors. Most often, communities respond first to the disaster, long before either NGOs or local-government machinery. Contrasting responses were obtained on the question of who responds first to an impending drought. Respondents in Romeas Haek felt that communities were the first to respond, through various community-level activities such as saving water and other adaptive practices listed later in the discussion (89 per cent). On the other hand, respondents in Rumduol thought that NGOs were the first to respond (71 per cent). No significant differences were found between male and female responses at the two locations.

Two kinds of agriculture-related drought-preparedness mechanisms were observed in study locations. These were the availability of drought-resistant seeds and management practices that help in reducing drought impacts. Respondents were of the opinion that there is a lack of drought-resistant seeds, with no significant difference in response from the gender groups. However, nearly 36 per cent of respondents felt that the seeds available were not adequate to cater for farmers' needs. Some also mentioned the high cost of drought-tolerant seeds.

Cropping strategies play an important role in reducing drought impacts. For example, mid-season corrections or crop-saving techniques that can be applied as part of drought management can help to save crops to a large extent. Responses indicated that there was a lack of knowledge about such practices, or that existing practices were inadequate and not much help in saving the crop.

**Table 20: Drought risk-reduction mechanisms**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| | **Male** | **Female** | **Male** | **Female** |
| **Drought-resistant seeds** | | | | |
| 1 Not available at all | 58 | 69 | 60 | 58 |
| 2. Available but not adequate | 40 | 31 | 34 | 38 |
| 3. Available but costly | 2 | 0 | 5 | 4 |
| 4. Do not know how to get them | 0 | 0 | 0 | 0 |
| **Suitable cropping strategies** | | | | |
| 1 Not available at all | 82 | 78 | 80 | 76 |
| 2. Available but not adequate | 16 | 22 | 8 | 11 |
| 3. Available but costly | 1 | 0 | 11 | 10 |
| 4. Available but do not know how to use them | 0 | 0 | 0 | 4 |

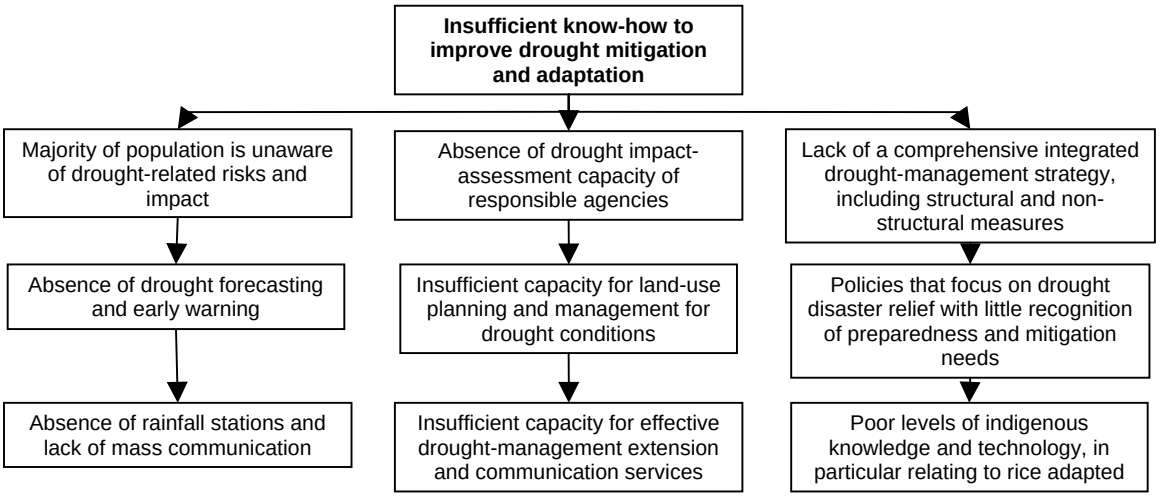
**Box 10: Two important barriers to drought mitigation and preparedness**

**Problem 1:** Insufficient availability of detailed information on the extreme variability of climatic and hydrological conditions in drought-prone areas of Svay Rieng province is a significant problem. Local people do not have enough information, and decisions to prepare for or to mitigate drought impacts currently lack the required support. A sufficiently detailed drought information system such as a functional forecasting and early warning system is currently not available to agencies.

**Problem 2:** The second problem is insufficient know-how concerning improved and tested drought preparedness, management, and mitigation strategies. This problem affects the vulnerability of people and of water-related systems in many ways. It relates to the loss of indigenous knowledge identified as a major problem in Cambodia, where the country's history of conflicts and migration has created an environment in which a large proportion of indigenous technologies and techniques have disappeared.

This problem relates to the current policy focus on short-term drought response. A comprehensive and integrated longer-term drought-management strategy comprising both structural and non-structural measures and know-how is missing. Other aspects that must be taken into account include the absence of drought impact-assessment capacity (tools and human resources) of responsible agencies, and insufficient land-use planning capacity for implementation. Finally, another contributing factor to vulnerability is the relatively poor capacity to communicate and provide extension services to people living in drought-affected areas.[25]

**Figure 10: Drought preparedness: problems in early warning and mitigation**




## 4.3.1. Drought response

The overall aim of drought response is to assist the most vulnerable and needy people among the affected population, to assist their recovery by enabling them to work, and to save what may be left of their crops. The objectives of drought-response programmes in the study locations, in particular, have been to provide food-for-work community-based infrastructure repair programmes that help to restore ponds and wells; to provide rice and other seeds such as vegetables, cassava, sweet potatoes, and corn; to build the capacity of communities and NGO partners to establish appropriate disaster preparedness and response plans; and to work in co-ordination with the National Committee for Disaster Management (NCDM).

**Table 21: Organisations active in responding to droughts and floods**

| Drought-affected districts | NGOs | Other organisations |
|---|---|---|
| • Rumduol<br>• Romeas Haek<br>• Kompong Ro<br>• Svay Chrum | • Oxfam<br>• Church World Service Cambodia (CWS) | • Provincial Disaster Management Committee (PDMC)<br>• World Food Programme (WFP)<br>• Cambodia Red Cross (CRC) |

Drought relief has been established as a standard practice globally, partly as a consequence of the inadequate development of preparedness and mitigation mechanisms. The supply of food, fodder, and water is a regularly reported practice. In Cambodia in general and at the study locations of Romeas Haek and Rumduol, however, this seems not to be the case. Almost all respondents in Romeas Haek (99 per cent) said that the distribution of food, fodder, and water had either not happened before or had not even been heard of. Very few respondents said that they had received water during past droughts. However, medicines had been distributed at Romeas Haek in the past. Drought-mitigation programmes seem still to be at a nascent stage in the study locations, with the majority of respondents being unaware that such programmes had been implemented in their location in the past.

**Table 22: Drought-relief activities**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| **Food** | | | | |
| 1. No relief | 100 | 99 | 95 | 88 |
| 2. Delayed relief supply | 0 | 0 | 2 | 3 |
| 3. Inadequate relief | 0 | 1 | 3 | 9 |
| 4. Improper distribution among communities | 0 | 0 | 0 | 0 |
| | | | | |
| **Fodder** | | | | |
| 1. No relief | 100 | 100 | 100 | 98 |
| 2. Delayed relief supply | 0 | 0 | 0 | 1 |
| 3. Inadequate relief | 0 | 0 | 0 | 1 |
| 4. Improper distribution among communities | 0 | 0 | 0 | 0 |
| | | | | |
| **Water** | | | | |
| 1. No relief | 95 | 97 | 95 | 93 |
| 2. Delayed relief supply | 3 | 2 | 2 | 0 |
| 3. Inadequate relief | 2 | 1 | 2 | 4 |
| 4. Improper distribution among communities | 0 | 0 | 2 | 2 |
| | | | | |
| **Medicines** | | | | |
| 1. No relief | 76 | 77 | 91 | 95 |
| 2. Delayed relief supply | 16 | 17 | 3 | 3 |
| 3. Inadequate relief | 8 | 6 | 3 | 1 |
| 4. Improper distribution among communities | 0 | 0 | 2 | 1 |

**Box 11: Gender-based approach to drought response**

Interviews with government officers indicated that they did understand the gender-disaggregated impacts of drought. They said they use this understanding while recruiting volunteers involved in drought response, and they ensure that sufficient female volunteers are recruited to help women in drought-affected areas. Officers also said that, based on the population information on gender, special relief requirements would be assessed and directed towards vulnerable groups. The distribution of medicines and other health-related assistance is one such decision that is based on the gender-specific impacts of drought, since officials understand that women are the most vulnerable to health-related problems during drought.

**'Drought has been a constant phenomenon since 2002. We received only 25kg of rice from the Cambodia Red Cross and nothing else from the government and other organisations.'**

*Prum Mum, Roung Snao village, Andong Pou commune, Romeas Haek*

## 4.4. Climate change

An effort was made to establish whether communities understand the differences between weather, season, and climate, and how they use such knowledge in their day-to-day lives. The majority of respondents understood what weather and climate were, although more respondents felt that they knew less about climate than they did about weather.

**Table 23: Weather and climate**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| **Weather** | | | | |
| 1. I understand | 83 | 80 | 71 | 77 |
| 2. Do not understand | 17 | 20 | 29 | 23 |
| | | | | |
| 1. Important for me | 93 | 93 | 95 | 91 |
| 2. Not important for me | 7 | 7 | 5 | 9 |
| | | | | |
| **Climate** | | | | |
| 1. I understand | 83 | 78 | 62 | 69 |
| 2. Do not understand | 17 | 22 | 38 | 31 |
| | | | | |
| 1. Important for me | 93 | 94 | 82 | 79 |
| 2. Not important for me | 7 | 6 | 18 | 21 |

Farmers in the region used their knowledge of weather to plan their crops and other agricultural activities. For example, they used this knowledge to decide when to irrigate their crops, when to spray pesticides, when to till, and when to harvest, etc. They used their knowledge of seasons to select the crops to be cultivated and which varieties, and to plan their livelihoods, such as planning for migration in a dry or lean season, planning jobs such as small-scale cottage industry, animal husbandry, etc.

Communities were somewhat divided in their views about whether and how the climate might be changing. They identify changes in temperatures and rainfall and changes in biodiversity, such as changes in the vegetation and animal species around them. However, opinions varied between Romeas Haek and Rumduol, and to some extent within the two communities (see Table 24). In

Romeas Haek most people said that temperatures were increasing steeply and rainfall declining, although some said the opposite. In Rumduol opinions were much more divided about temperature trends, but almost unanimous that rainfall is decreasing.

According to the Food and Agriculture Organization, biodiversity in Cambodia is one of the poorest in the region. Cambodian forests contain 862 tree species.[26] By comparison, elsewhere in the region, Malaysian forests have 2,650 species while there are 2,000 species in Burma and 3,000 in the Philippines.

**Table 24: Changes in temperature, rainfall, and biodiversity**

| | | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|---|
| | **Trend** | **Male** | **Female** | **Male** | **Female** |
| **Temperature** | 1. Decreasing steeply | 16 | 10 | 42 | 35 |
| | 2. Decreasing moderately | 6 | 7 | 13 | 10 |
| | 3. No change | 0 | 0 | 2 | 4 |
| | 4. Increasing moderately | 14 | 25 | 5 | 13 |
| | 5. Increasing steeply | 64 | 58 | 39 | 38 |
| | | | | | |
| **Rainfall** | 1. Decreasing steeply | 19 | 11 | 58 | 65 |
| | 2. Decreasing moderately | 52 | 49 | 31 | 23 |
| | 3. No change | 4 | 10 | 0 | 4 |
| | 4. Increasing moderately | 16 | 15 | 2 | 2 |
| | 5. Increasing steeply | 9 | 15 | 9 | 6 |
| | | | | | |
| **Biodiversity** | 1. Decreasing steeply | 11 | 4 | 36 | 28 |
| | 2. Decreasing moderately | 64 | 72 | 54 | 57 |
| | 3. No change | 13 | 14 | 3 | 8 |
| | 4. Increasing moderately | 11 | 10 | 2 | 5 |
| | 5. Increasing steeply | 0 | 0 | 5 | 1 |

## 4.4.1. Climate change and natural hazards

Climate change is known to manifest itself through changes in rainfall events, with the number and intensity of such events increasing in some locations and decreasing in others. Higher rainfall has been explained by the fact that increased warming enhances evaporation, leading to a high moisture content in the atmosphere. However, increased moisture content need not necessarily mean a uniform distribution of high rainfall throughout a geographical region. Some regions can be expected to receive high levels of rainfall, leading to floods, while others may face an extreme shortage of rainfall, leading to drought.

Responses to questions about trends in natural hazards were very mixed and often contradictory (see Table 25). In Romeas Haek opinion tended towards there being little or no change in the number or intensity of floods, but was much more sharply divided about whether the same applied to droughts. Some felt they were declining in number and intensity; rather more felt they were increasing. In Rumduol opinions about floods were sharply divided, but most people said that droughts were decreasing both in number and intensity.

**Table 25: Past trend of natural hazards**

| Natural hazard | Trend | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|---|
| | | Male | Female | Male | Female |
| **Number of floods** | 1. Decreasing steeply | 16 | 10 | 42 | 35 |
| | 2. Decreasing moderately | 4 | 7 | 13 | 10 |
| | 3. No change | 50 | 50 | 2 | 4 |
| | 4. Increasing moderately | 9 | 11 | 5 | 13 |
| | 5. Increasing steeply | 20 | 22 | 39 | 38 |
| | | | | | |
| **Intensity of floods** | 1. Decreasing steeply | 12 | 8 | 58 | 65 |
| | 2. Decreasing moderately | 28 | 25 | 31 | 23 |
| | 3. No change | 54 | 54 | 0 | 4 |
| | 4. Increasing moderately | 3 | 3 | 2 | 2 |
| | 5. Increasing steeply | 3 | 9 | 9 | 6 |
| | | | | | |
| **Number of droughts** | 1. Decreasing steeply | 3 | 4 | 36 | 28 |
| | 2. Decreasing moderately | 38 | 34 | 54 | 57 |
| | 3. No change | 7 | 8 | 3 | 8 |
| | 4. Increasing moderately | 3 | 5 | 2 | 5 |
| | 5. Increasing steeply | 50 | 49 | 5 | 1 |
| | | | | | |
| **Intensity of droughts** | 1. Decreasing steeply | 4 | 7 | 34 | 37 |
| | 2. Decreasing moderately | 33 | 31 | 52 | 44 |
| | 3. No change | 13 | 8 | 3 | 5 |
| | 4. Increasing moderately | 0 | 5 | 5 | 13 |
| | 5. Increasing steeply | 50 | 49 | 7 | 1 |
| | | | | | |
| **Number of epidemics** | 1. Decreasing steeply | 14 | 9 | 44 | 38 |
| | 2. Decreasing moderately | 11 | 8 | 2 | 3 |
| | 3. No change | 4 | 7 | 0 | 0 |
| | 4. Increasing moderately | 33 | 30 | 0 | 1 |
| | 5. Increasing steeply | 39 | 46 | 54 | 58 |

Mixed responses were obtained about the number of heavy rainfall events (see Table 26). In both Romeas Haek and Rumduol, responses were balanced between ‘moderately decreasing’ and ‘moderately increasing’, with no significant differences between the genders. Similarly contradictory responses were obtained when respondents were asked about the intensity of heavy rainfall events, with some people saying intensity had increased, others that it had decreased.

**Box 12: What does local government think about climate change, and what is it doing?**

Interviews with government officers revealed their opinions on climate, the changes taking place, and the reasons behind them. Officers interviewed included the Deputy District Governor, the Director of the Cambodia Red Cross, commune councils, village chiefs and deputy chiefs, and the District Chief of the Agricultural Office. The following describes their insights into the issues related to reducing drought risk in the region.

- All the officials interviewed were aware of the climate and the fact that it has been changing over the years.
- However, most of the officials did not use their knowledge about the changing climate in their daily work, either because they did not know how to respond to climate change or because they were not responsible specifically for making plans to deal with it.
- They observed that the disaster profile of the region has been changing over the years, and believed that global changes were more responsible for this than changes taking place in their immediate vicinity.
- Rainfall has been decreasing over the years, the days have became hotter, and seasons are unpredictable in their behaviour.
- However, a certain amount could be done in response to the changes observed. The most significant work carried out in this respect is to establish canal irrigation systems and food-for-work programmes. Officials also explained that the changing climate encouraged them to be more prepared, finding more funds for irrigation systems, conducting capacity-building programmes in agriculture and animal husbandry, providing high-yielding varieties of seeds, and raising awareness among communities about the changes happening and the need for enhanced preparedness.
- Agriculture is the sector most vulnerable to climate change, followed by animal husbandry. Human health impacts were also identified as important in the context of climate change.
- The success of adaptation programmes depends on the participation of local communities, which currently is reported to be very poor. Other problems, such as an absence of donor agencies supporting long-term projects, are hampering drought risk-reduction initiatives in the region.
- The lack of funds was cited as a significant problem hindering the launch of useful risk-reduction programmes, such as livelihood diversification, in the region. Officials believe that large amounts of money are required for livelihood diversification and to stop migration.
- Capacity at the commune level is not sufficient to assess drought conditions or to initiate proactive drought risk-reduction measures. Responses are always delayed as drought assessment is carried out at the district level.
- Some important drought risk-reduction initiatives that have been adopted include the distribution of fast-growing rice cultivars, training on agricultural practices, training of villagers in animal husbandry and veterinary practices, and the establishment of teaching on integrated pest management.
- The human, financial, and technical capabilities of local governments were reported to be insufficient when compared with those of NGOs.

**Table 26: Behaviour of heavy rainfall events in study locations**

| | | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|---|
| | **Trend** | **Male** | **Female** | **Male** | **Female** |
| **Number of heavy rainfall events** | 1. Decreasing steeply | 8 | 3 | 18 | 19 |
| | 2. Decreasing moderately | 38 | 39 | 27 | 22 |
| | 3. No change | 9 | 14 | 0 | 3 |
| | 4. Increasing moderately | 38 | 36 | 32 | 35 |
| | 5. Increasing steeply | 7 | 8 | 23 | 22 |
| | | | | | |
| **Intensity of heavy rainfall events** | 1. Decreasing steeply | 8 | 3 | 18 | 19 |
| | 2. Decreasing moderately | 41 | 41 | 26 | 21 |
| | 3. No change | 0 | 2 | 0 | 3 |
| | 4. Increasing moderately | 44 | 46 | 31 | 31 |
| | 5. Increasing steeply | 7 | 8 | 26 | 27 |

## 4.4.2. Reasons for the changes observed

Respondents were asked what they believed to be the reasons behind any changes. This question was aimed at establishing whether communities believe that they themselves contribute to an increase in natural hazards and the resultant losses. The majority of the respondents could not say why disaster patterns were changing, whether their own actions or global changes contributed to such changes. Some however felt that local changes were responsible for the increase in the frequency of disasters. Among those who thought that local changes were responsible, the great majority thought that deforestation was the primary cause. Curiously, the number who did mention global changes was larger in Rumduol than in Romeas Haek.

The concern about deforestation tallies with FAO statistics, which indicate that forest cover in Cambodia declined from 12.9m hectares in 1990 to 10.4m hectares in 2005, with an annual change rate of -2 per cent. This was due mostly to illegal logging, population growth, and rapid development. Only 3.1 per cent of the total forest area in Cambodia is primary forest that is rich in biodiversity.

**Table 27: Reasons for changes in disaster patterns**

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| | **Male** | **Female** | **Male** | **Female** |
| 1 Due to local changes | 11 | 4 | 8 | 4 |
| 2. Due to global changes | 2 | 1 | 16 | 16 |
| 3. Cannot say | 87 | 95 | 77 | 80 |
| | | | | |
| 1. Increasing population | 4 | 2 | 6 | 1 |
| 2. Deforestation | 80 | 75 | 86 | 82 |
| 3. Industrialisation | 0 | 0 | 0 | 0 |
| 4. Environmental pollution | 0 | 0 | 2 | 3 |
| 5. Greater use of fossil fuels | 0 | 0 | 0 | 2 |

| | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 6. Others (forest fires, shifting cultivation patterns) | 17 | 19 | 0 | 0 |
| 7. Cannot say | 0 | 3 | 6 | 12 |

## 4.4.3. Adaptation strategies

Adaptation is an important means of reducing climate-change impacts. Adaptation includes all those activities that an individual, community, government, or institution does in response to climate stimuli. Adaptation can either be autonomous – reactive – or planned in advance. Autonomous adaptation refers to actions taken during or after experiencing the impacts of climate change. This kind of adaptation generally involves suffering losses and so is not ideal. Planned adaptation includes all those actions taken in anticipation of climate-change impacts. These decisions are the most difficult to make, since climate change involves uncertainty, and human resources and financial investments may go to waste if the course of action decided on turns out to be the wrong one. As decisions of this kind are important, we tried to identify both types of decision made at the community level (see Table 28). However, it is difficult to distinguish in practice between the two. Digging wells, planning new cropping systems, or storing rice or fodder may come under either category, depending on circumstances including intention, timing, the degree of planning, and so on.


**'We have a pump provided by Oxfam, but we haven't been able to use it because of high oil prices.'**

*Tep Leong, Roung Snao village, Andong Pou commune, Romeas Haek*

**Plate 4: A diesel pump set provided by PADEK and Oxfam**

The most commonly cited adaptation strategies were the selection of appropriate crop varieties and the planning of cropping systems. The diversification of cropping systems seems to be the most widespread adaptation strategy in Rumduol, where farmers grow flowers and vegetables such as carrots, garlic, etc. that can fetch a good price at market, rather than traditional staple food crops. Storing rice for use during lean seasons seems to be a standard 'safe practice' in both communities. Respondents also reported taking up animal husbandry, which gives them a 'buffer' against fluctuations in income from agriculture. Storing fodder is also a common strategy to safeguard against scarcity during dry seasons. Other important adaptation options include exploring alternative livelihood options such as working on construction sites, maintaining small-scale shops, making liquor or bakery products, and selling noodles or mangoes.

Among adaptation options that might be more planned in nature, providing high-yielding seed varieties, training on better agricultural practices, and digging ponds and wells were identified as

important. Other planned options identified were the provision of pumps by PADEK and Oxfam and the promotion of animal husbandry by distributing chickens and ducks to the community to encourage poultry rearing.

**Table 28: Autonomous and planned adaptation strategies identified by communities**

| Adaptation type | Romeas Haek | | Rumduol | |
|---|---|---|---|---|
| | **Kouk Srama** | **Ta Naeng** | **Thmei** | **Rong Snao** |
| **Autonomous** | • Selection of appropriate crop varieties<br>• Storing rice and other food items<br>• Storing fodder for animals<br>• Animal husbandry<br>• Exploration of other livelihood options such as working on construction sites, selling mangoes, bakery, etc. | • Planning appropriate cropping systems<br>• Animal husbandry<br>• Digging wells<br>• Storing rice for lean seasons<br>• Planting vegetables<br>• Gaining skills other than agricultural | • Planting morning glory, carrot, garlic<br>• Not cultivating rice in dry season<br>• Start planting when the rains come<br>• Plant mangoes on the bunds in paddy fields<br>• Delay cultivation period for rice<br>• Animal husbandry<br>• Culling animals | • Diversification of cropping systems<br>• Digging wells and ponds<br>• Storing rice<br>• Livelihood diversification, including processing rice, working as construction labour, making sugar palm wine, selling noodles, etc. |
| **Planned** | • Provision of better crop seeds<br>• Digging wells | • PADEK training on agricultural techniques<br>• Pump well provided by Santi Sena<br>• Rice seed provided by PADEK<br>• Pump provided by Oxfam<br>• Pump well provided by private companies | • Seeds provided by PADEK<br>• PADEK food-for-work programme, digging ponds and canals<br>• Food provided by Cambodia Red Cross | • Digging ponds<br>• Food distribution<br>• Distribution of clothes<br>• Provision of chickens and ducks to promote poultry rearing |

The adaptation options listed here show that there have been insufficient efforts to identify appropriate and effective adaptation options for these communities. There are very few NGOs active in the region: communities only mentioned interventions by Oxfam and PADEK (Partnership for Development in Kampuchea) as being significant.

# 5. Policy options

In this section, policy options are identified for combating vulnerability to climate change. These policy options are derived from the survey results cited in the preceding sections, including results from participatory approaches and from existing literature. As discussed in the section on methodology, the root causes of vulnerability to drought were identified first in a participatory manner, and then the actions needed to overcome these vulnerabilities were identified.

## *5.1. Root causes of vulnerability to drought*

Root causes were identified via a participatory process in which focus group participants were asked to list the impacts of drought and to rank them according to the importance they placed on each. Subsequently, they were questioned on why a particular impact was felt and the reason behind it. Searching questions continued up to the point where participants could go no further in identifying and analysing the problem. The results of this process were identified as root causes.

Table 29 provides a list of drought impacts, grouped and ranked. The most significant impacts are damage to crops, loss of income from crops and animal husbandry activities, social problems such as disputes among community members, and health and environmental problems, such as poor air quality due to increased dust in the atmosphere and the loss of forests.

**Table 29: Impacts of drought identified during FGDs (ranked and grouped)**

| Category | Sub-category | Romeas Haek district | Rumduol district |
|---|---|---|---|
| **Economic** | Agriculture | 1. Damage to crops<br>2. Low yields<br>3. Loss of income<br>4. Insect pests<br>5. No cultivation in some seasons<br>6. Lack of seeds<br>7. Delay in field operations<br>8. Low-quality produce | 1. Damage to crops<br>2. Low yields<br>3. Loss of income<br>4. Insect pests<br>5. Lack of seeds<br>6. Poor germination<br>7. Low-quality produce |
| | Animal husbandry | 1. Loss of income<br>2. Disease<br>3. Increased pests in livestock<br>4. Lack of fodder<br>5. Higher mortality rates among livestock | 1. Loss of income<br>2. Disease<br>3. Higher mortality rates of livestock<br>4. Lack of fodder<br>5. Forced sale of livestock |
| **Social** | Health and nutrition | 1. Stress<br>2. Headaches due to high temperature<br>3. Diseases such as diarrhoea, typhoid fever<br>4. Reduction in nutrition | 1. Stress<br>2. Headaches due to high temperature<br>3. Diseases such as diarrhoea, typhoid fever<br>4. Reduction in nutrition |
| | Social security | 1. Increased conflicts over water use (conflict between different communities)<br>2. Unemployment | 1. Unemployment<br>2. Social disputes |
| | Others | 1. Children dropping out of school<br>2. Migration<br>3. Higher unemployment rates | 1. Children dropping out of school<br>2. Migration<br>3. Low marriage rate<br>4. Higher unemployment rates |
| **Environmental** | | 1. Loss of forests<br>2. Exhaustion of crop fields<br>3. Loss of biodiversity<br>4. Decreased air quality due to dust and pollutants | 1. Exhaustion of crop fields<br>2. Loss of biodiversity |

After identifying important problems in each village, the process went on to identify the root cause for each problem. Figure 11 provides a sample problem tree that digs down to the root cause for low productivity in rice cultivation. In this case, the root causes were found to be insufficient capacity to build irrigation systems and a lack of capacity to buy market inputs such as fertilisers. A similar assessment was carried out for the animal husbandry sector, and an indicative problem tree diagram is provided in Figure 12.

**Figure 11: Root causes of vulnerability in agriculture sector**

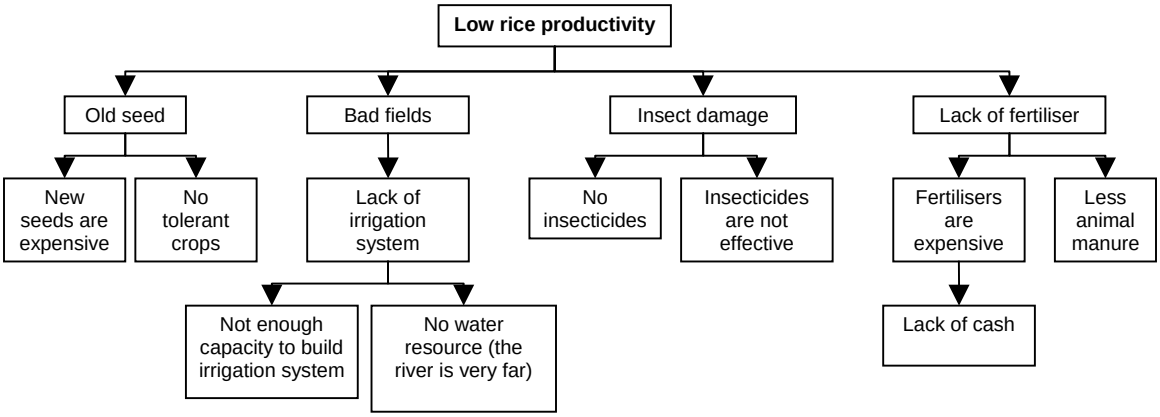
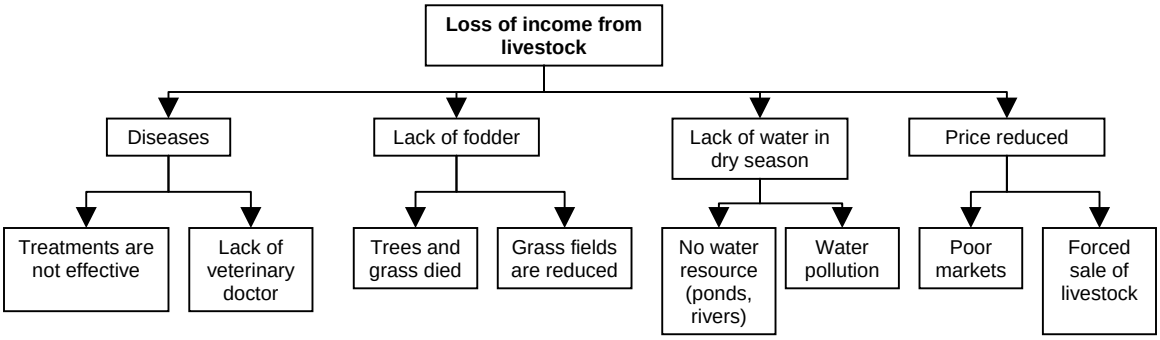



**Figure 12: Root causes of vulnerability in animal husbandry sector**




The root causes thus identified were discussed by community members, in order to find a possible solution for each problem. Table 30 provides a list of root causes for each impact identified in Table 29.

**Table 30: Impacts and their root causes**

| Category | Impacts | Root cause/s |
|---|---|---|
| **Agriculture** | Damage to crops/low yields/loss of income | • Less access to drought-tolerant crops<br>• Lack of irrigation facilities<br>• Lack of access to improved management practices |
| | Lack of water | • Insufficient funding for irrigation facilities |
| | Insect pests and diseases | • Lack of access to pest- and disease-resistant crop varieties suitable for the region<br>• Lack of access to integrated pest-management practices<br>• High cost of pesticides |
| | Land not cultivated in some seasons | • Extreme drought<br>• Lack of irrigation facilities |
| | Lack of seeds | • Poor market-chain mechanism<br>• No government support for seed supply |
| | Delay in field operations | • Late onset of monsoon<br>• Lack of irrigation facilities |
| | Low-quality produce | • Lack of irrigation facilities<br>• Lack of better management practices such as mid-season thinning, etc. for quality crop |
| | Poor germination | • Lack of essential irrigation<br>• Poor-quality seeds<br>• Lack of better management practices for ensuring germination |
| **Animal husbandry** | Loss of income | • Lack of sufficient fodder and water<br>• Lack of improved breeds that are drought-tolerant |
| | Disease and pests | • Lack of drought-tolerant breeds<br>• Lack of disease-resistant breeds<br>• Insufficient veterinary facilities |
| | Lack of fodder | • Lack of water<br>• Insufficient storage facilities for fodder |
| | Higher mortality rates among livestock | • Insufficient veterinary facilities<br>• Lack of fodder and water |
| | Forced sale of livestock | • Not enough income to maintain livestock<br>• Lack of drought-tolerant livestock breeds |
| **Social security** | Increased conflicts over water use (conflict between different communities) | • Lack of assured irrigation and drinking water facilities |
| | Unemployment | • Lack of alternative employment facilities |
| | Disputes within families and between families | • Poor income<br>• Few resources such as water, fodder, and employment |
| **Health and nutrition** | Heat stress/headaches due to high temperatures | • Necessity to work through drought for minimum income |
| | Diseases such as diarrhoea, typhoid fever | • Poor water quality<br>• Lack of sufficient medical facilities<br>• No advanced warning or know-how on how to deal with the situation |
| | Malnutrition | • Lack of sufficient food |

| Category | Impacts | Root cause/s |
|---|---|---|
| | | • Lack of income |
| **Other social problems** | Children dropping out of school | • Lack of income diversification |
| | Migration | • Lack of income diversification |
| | Higher unemployment rates | • Lack of income diversification |
| | Low marriage rate | • Lack of income diversification |
| **Environment** | Loss of forests | • Lack of income diversification |
| | Exhaustion of crop fields | • Lack of know-how on better crop-management practices<br>• Poor inputs due to poverty |
| | Loss of biodiversity | • Deforestation |
| | Decreased air quality due to dust and pollutants | • Deforestation |

Since many impacts have common root causes, and because the solutions for these root causes are similar, the root causes were grouped. Table 31 lists all the grouped root causes and solutions identified.

**Table 31: Root causes and solutions**

| Grouped root cause/s | Identified solutions |
|---|---|
| • Deforestation | • Promotion of community forestry and agro-forestry<br>• Provision of shared and controlled use of forest assets for community members<br>• Provision of livelihood diversification options such as those identified below |
| • High cost of pesticides | • Training of farmers on integrated pest-management practices |
| • Insufficient storage facilities for fodder | • Establishment of community fodder banks<br>• Encouraging community fodder preservation activities, such as making village-level feed concentrates using locally available components |
| • Insufficient veterinary facilities | • Training educated farmers on better veterinary practices<br>• Establishment of village veterinary centres |
| • Lack of access to improved management practices | • Training farmers on better crop-management practices<br>• Strengthening agriculture department with more village-level workers |
| • Lack of access to integrated pest-management practices | • Training farmers on integrated pest-management practices |
| • Lack of alternative employment facilities/income diversification | • Training rural people on different livelihood options<br>• Promoting rural cottage industries |
| • Lack of improved animal breeds that are drought- and pest-tolerant | • Strengthening local veterinary departments<br>• Implementing artificial insemination programmes<br>• Promoting crossbreeds through subsidies and loans |
| • Lack of irrigation facilities | • Enhanced funding for irrigation projects<br>• Renovation of existing canals and dams<br>• Promotion of water harvesting<br>• Promotion of water-saving practices/enhancing water efficiency in all rural sectors/minimising waste |
| • Lack of sufficient food (malnutrition) | • Training mothers on better nutrition<br>• Distribution of nutrient-rich food for children and lactating mothers<br>• Better medical facilities |
| • Late onset of monsoon | • Strengthening drought early warning systems<br>• Promoting in situ water conservation for better |

| Grouped root cause/s | Identified solutions |
|---|---|
| | moisture in the soil |
| • Lack of access to drought-, pest-, and disease-tolerant crops | • Distribution of high-yielding varieties<br>• Promoting participatory plant-breeding techniques that make seeds available locally<br>• Strengthening agriculture department<br>• Controlling the price of seeds through government regulation |
| • Necessity of working through drought for minimum income | • Livelihood diversification<br>• Strengthening credit facilities for non-farm activities during off-season and drought conditions<br>• Promotion of rural cottage idustries |
| • No government support for seed supply | • Strengthening seed-supply system through better planning at the local level and use of weather forecasts<br>• Controlling seed prices in the open market through regulation and quality-control operations |
| • Poor crop inputs due to poverty | • Promoting sustainable agricultural practices such as reduced tillage<br>• Promoting better management practices with high efficiency of input use<br>• Strengthening local agricultural departments for better extension support |
| • Poor water quality | • Education on water-sanitation practices<br>• Distribution of chlorine tablets for disinfection<br>• Promotion of water conservation practices such as rooftop rainwater-harvesting systems that will help in improving access to water |
| • No advanced warning or know-how on how to deal with the situation | • Improving the weather forecasting system<br>• Improved access to quality weather forecasts by establishing community-level weather-forecast dissemination centres<br>• Training local agricultural department personnel to help design agricultural practices in line with weather forecasts |

## *5.2. Identification of effective solutions*

Having identified the solutions presented above, community members were asked to pick out the solution that would best help them to reduce their vulnerability to climate-related events such as droughts.

Climate change and its related impacts require action at the local level, and any such action will require the involvement of multiple stakeholders. Community involvement is paramount in designing and implementing climate-change adaptation decisions at the local level, as we have seen that communities are the first to be affected and that they need more knowledge about climate change and its impacts. Efforts were made to identify solutions for the problems identified in a participatory manner. Participants were asked to grade the usefulness of solutions such as income diversification, improving livelihoods, better education, access to markets, and even direct financial support.

**Box 13: Consideration of gender in drought mitigation and adaptation**

Analysis of the current drought-management situation in Cambodia indicates the need to further develop consciousness of gender in disaster response and management. All disasters should be seen as social events that have their roots in social systems and structures. Since there are differences in society, inequalities and vulnerabilities are not distributed equally, and there is a differential impact of disasters on people.

Women are among the most vulnerable, due to their subordinate social and economic positions within the family and in society as a whole. Absence of a gender focus in drought management, especially in relief interventions, reinforces gender and class biases. There is a need to create greater gender awareness among policy makers, civil-society organisations, donor agencies, and those working to protect people from the effects of disasters, to understand women's vulnerabilities, and to use disaster-management efforts to enhance their capacities to deal with such events.

Another important shift that is urgently needed is a move from relief to disaster mitigation. Svay Rieng is a poor province and cannot afford to maintain a relief-oriented approach for a long time, as this is extremely expensive. Policy makers need to involve people from disaster-prone areas in disaster preparedness and mitigation.

Respondents were of the opinion that income diversification is the most important and useful solution for reducing climate-related vulnerabilities. Responses were similar across both locations and genders. The second option chosen was the improvement of existing livelihoods. While more women were neutral on the question of improving livelihoods, more men felt that there was a need for improvement. Better education was chosen as the third most important option for reducing vulnerability. More women than men thought that education was important.

Access to markets is also important, enabling farmers to get better prices for their produce and making a difference to their economic status. Perhaps surprisingly, more female respondents thought that access to markets was important than male respondents. Also, more respondents from Romeas Haek thought that this was important than respondents from Rumduol. Again perhaps surprisingly, respondents in both locations thought that financial support was not very important in reducing their vulnerability to climate change; they felt that without adequate back-up on capacity-building and livelihood diversification such support would be ineffective. This observation was in contrast with the debt problem identified in earlier sections. This would seem to indicate that communities want long-term solutions.

**Table 32: Solutions for reducing vulnerability to climate change**

| | Grade (1 = most important, 5 = least important) | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|---|
| | | Male | Female | Male | Female |
| **Income diversification** | 1 | 29 | 39 | 44 | 44 |
| | 2 | 40 | 40 | 37 | 39 |
| | 3 | 22 | 16 | 16 | 12 |
| | 4 | 8 | 3 | 3 | 3 |
| | 5 | 0 | 1 | 0 | 1 |
| | | | | | |
| **Improving livelihoods** | 1 | 12 | 8 | 22 | 12 |
| | 2 | 19 | 11 | 18 | 24 |

| | Grade (1 = most important, 5 = least important) | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|---|
| | | Male | Female | Male | Female |
| | 3 | 47 | 56 | 36 | 38 |
| | 4 | 15 | 21 | 19 | 22 |
| | 5 | 6 | 4 | 6 | 3 |
| | | | | | |
| **Better education** | 1 | 11 | 2 | 5 | 8 |
| | 2 | 17 | 19 | 15 | 23 |
| | 3 | 31 | 24 | 40 | 25 |
| | 4 | 34 | 47 | 24 | 32 |
| | 5 | 7 | 9 | 17 | 12 |
| | | | | | |
| **Access to markets** | 1 | 12 | 22 | 14 | 16 |
| | 2 | 19 | 22 | 23 | 21 |
| | 3 | 19 | 19 | 17 | 22 |
| | 4 | 23 | 18 | 30 | 26 |
| | 5 | 27 | 19 | 16 | 15 |
| | | | | | |
| **Financial support** | 1 | 7 | 4 | 18 | 9 |
| | 2 | 16 | 12 | 11 | 16 |
| | 3 | 17 | 16 | 24 | 29 |
| | 4 | 19 | 28 | 11 | 20 |
| | 5 | 42 | 40 | 37 | 27 |

Institutions play an important role in capacity-building in communities and in reducing their vulnerability to climate change. Five types of institution were considered in the questionnaire: communities, NGOs, local governments, provincial governments, and central government. In general, communities believed that NGOs played an important role in reducing their vulnerability to climate change. In Romeas Haek, communities themselves were thought to play the second most important role in reducing vulnerabilities, while in Rumduol local government was considered to be important. More respondents believed that the provincial and central governments played the least important role in reducing their vulnerability to climate change.

**Table 33: Role of different institutions in capacity-building of communities**

| Institution | Grade (1 = most important, 5 = least important) | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|---|
| | | Male | Female | Male | Female |
| | | | | | |
| **Communities** | 1 | 18 | 28 | 7 | 13 |
| | 2 | 21 | 12 | 41 | 28 |
| | 3 | 45 | 44 | 32 | 46 |
| | 4 | 10 | 10 | 15 | 9 |
| | 5 | 6 | 5 | 5 | 4 |
| | | | | | |
| **NGOs** | 1 | 24 | 21 | 36 | 24 |
| | 2 | 29 | 25 | 20 | 25 |

| Institution | Grade (1 = most important, 5 = least important) | Romeas Haek (%) | | Rumduol (%) | |
|---|---|---|---|---|---|
| | | Male | Female | Male | Female |
| | 3 | 25 | 25 | 25 | 24 |
| | 4 | 12 | 15 | 12 | 20 |
| | 5 | 10 | 14 | 8 | 7 |
| | | | | | |
| **Local government** | 1 | 12 | 5 | 20 | 15 |
| | 2 | 25 | 24 | 20 | 29 |
| | 3 | 25 | 24 | 34 | 24 |
| | 4 | 23 | 35 | 19 | 17 |
| | 5 | 15 | 11 | 7 | 15 |
| | | | | | |
| **Provincial government** | 1 | 8 | 10 | 8 | 9 |
| | 2 | 9 | 13 | 18 | 11 |
| | 3 | 12 | 13 | 16 | 19 |
| | 4 | 37 | 34 | 31 | 35 |
| | 5 | 34 | 30 | 27 | 26 |
| | | | | | |
| **Central government** | 1 | 7 | 3 | 9 | 15 |
| | 2 | 8 | 8 | 8 | 5 |
| | 3 | 14 | 15 | 25 | 17 |
| | 4 | 20 | 25 | 29 | 21 |
| | 5 | 51 | 49 | 29 | 43 |

# 6. Notes

[1] Ministry of Planning (2003) 'Poverty and Vulnerability Analysis Mapping in Cambodia. Summary Report, Ministry of Planning, Royal Government of Cambodia, and World Food Program', www.foodsecurity.gov.kh/docs/KHM/Poverty%20-%20Vulnerability%20Analysis%20Mapping-ENG.pdf.

[2] AusAID and Agrifood Consulting International (2006) 'Cambodia Agriculture Sector Diagnostic Report', www.ausaid.gov.au/publications/pdf/cambodia/agriculture_report.pdf.

[3] World Bank (2006) 'Cambodia Halving Poverty by 2015? Poverty Assessment 2006', Phnom Penh: World Bank.

[4] S. Chinvanno (2003) 'Results from Regional Climate Modelling and their Future Use in Analysis of Hydrologic Impacts in Mekong River Basin', paper presented at First AIACC Regional Workshop and Open Meeting for Asia-Pacific, 24–27 March 2003, Bangkok, www.aiaccproject.org/meetings/Bangkok.html

[5] C. Knutson, M. Hayes, and T. Phillips (1998) 'How to Reduce Drought Risk', Western Drought Coordination Council, National Drought Mitigation Centre, Nebraska, USA.

[6] World Bank (2005) Remarks by Governor of Svay Rieng Province at the National Forum on Cambodia's Agrarian Structure in the Context of Trade Integration, Hhttp://siteresources.worldbank.org/INTCAMBODIA/Resources/Annex-20.pdf

[7] www.camnet.com.kh/moe-library/newsinformation.htm

[8] S. Nam, T. Savuth, and N. Thuok (2000) 'Cambodia Natural Resource Evaluation', prepared for World Bank Agricultural Productivity Improvement Project. Department of Fisheries, Kingdom of Cambodia.

www.ifredi.org/Documents/publications/phase2/socio/so_nam_et_al_2000_cambodia_natural_resource_evaluation.pdf

[9] UNDP/IUCN/MRC/GEF (2005) 'Vulnerability Assessment Climate Risks in Stung Treng Province, Cambodia', www.mekongwetlands.org/Common/download/Cambodia_Vulnerability_Assessment_w_cover.pdf

[10] Ministry of Planning (1998 and 2005) 'General Population Census of Cambodia 1998', 'General Population Census of Cambodia 2005', National Institute of Statistics, Phnom Penh, Cambodia.

[11] 2005 Census.

[12] WFP (2006) 'Food Security Atlas of Cambodia', www.methodfinder.com/wfpatlas/index.php?page=042002&lang=e.

[13] H.J. Nisbett and K. Helers (1996) 'Rice in the Cambodian Economy: Past and Present, Rice Production in Cambodia', Cambodia–IRRI–Australia Project.

[14] UN (2003) United Nations Transitional Authority in Cambodia, www.un.org/Depts/dpko/dpko/co_mission/untac.htm

[15] EM-DAT (2007) The OFDA/CRED International Disaster Database, www.em-dat.net. Université Catholique de Louvain, Brussels, Belgium, www.em-dat.net/disasters/Visualisation/emdatselectors.php

[16] WFP-VAM (2001) 'Identifying Poor Areas in Cambodia Combining Census and Socio-Economic Survey Data to Trace the Spatial Dimensions of Poverty', World Food Programme, Government of Cambodia, and United Nations Development Programme, www.wfp.org/operations/vam/country_experience/cambodia_vam/index.asp

[17] N.H. Ninh (1999) 'The Impact of El Niño and La Niña on Southeast Asia: the human dimension, policy lessons and implications for global change', a workshop and related information project (APN 99003), APN Project Report. Center for Environment Research, Education and Development (CERED), Hanoi, Viet Nam, www.apn-gcr.org/en/products/project_reports/1999/pdf/1999-03.pdf.

[18] CIDI (2002) 'Cambodia: Drought – ACT: 15 October 2002. Situation Report of Drought by Action by Churches Together', Centre for International Disaster Information, http://cidi.org/disaster/02b/ixl144.html.

[19] T.B. McKee, N.J. Doesken, and J. Kleist (1993) 'The Relationship of Drought Frequency and Duration to Time Scales', Eighth Conference on Applied Climatology, Anaheim, CA, 17–22 January 1993, American Meteorological Society, pp. 179–84.

[20] Department of Water Resource and Meteorology in Svay Rieng.

[21] IFRC (2001) 'Cambodia: Floods 2001. Final Report', International Federation of Red Cross and Red Crescent Societies, Cambodia, www.ifrc.org/cgi/pdf_appeals.pl?01/2901FR.pdf.

[22] IFAD (2003) 'Report and recommendation of the President to the Executive Board on a proposed loan to the Kingdom of Cambodia for the rural poverty reduction project in Prey Veng and Svay Rieng', International Fund for Agricultural Development, www.ifad.org/gbdocs/eb/80/e/EB-2003-80-R-30-REV-1.pdf.

[23] Ministry of Environment (2006) 'National Adaptation Programme of Action to Climate Change (NAPA)', Hhttp://unfccc.int/resource/docs/napa/khm01.pdfH.

[24] Ministry of Environment (2001) 'Vulnerability and Adaptation Assessment to Climate Change in Cambodia. Final Draft', Climate Change Enabling Activity Project CMB/97/G31, Ministry of Environment, UNDP/GEF, www.camclimate.org.kh/5Publications/VandA/V&A.pdf.

[25] T.E. Navuth (2007) 'Drought Management in the Lower Mekong Basin', 3rd Southeast Asia Water Forum, 22–26 October 2007, Kuala Lumpur, Malaysia; D.A. Wilhite (2005) 'Drought and Water Crises: Science, Technology, and Management Issues', CRC Press Taylor & Francis Group, NW, USA; Ministry of Agriculture, Forestry and Fisheries (2002, 2003, 2004, 2005) 'Annual Report on Agriculture, Forestry and Fisheries', Phnom Penh, Cambodia; Ministry of Planning (2000) General Population Census of

Cambodia 1998, Analysis of Census Results, op. cit., pp. 16–23; Ministry of Planning (2006) 'Cambodia Statistical Yearbook 2005', National Institute of Statistics, pp.79–107, Phnom Penh, Cambodia.

[26] FAO (2006) 'Global Forest Resource Assessment 2005. Progress towards sustainable forest management', FAO Forestry Paper 147, FAO, Rome, p. 320.