

**Drought Management Considerations for Climate
Change Adaptation: Focus on the Mekong Region
REPORT (VIETNAM)**



**Oxfam-Vietnam, and
Graduate School of Global Environmental Studies of
Kyoto University, Japan**



Participants of the national forum conducted in Hanoi, Vietnam

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Preface

The Mekong River plays an important role in the wellbeing of China, Cambodia, Laos, Myanmar, Thailand and Vietnam as it is the major river supporting agriculture and many other economic activities in the region. It also brings regular floods to the region which, although sometimes damaging, are an integral part of the lives of many in the Mekong River basin. However, during recent times, one can see reports of the Mekong River basin increasingly becoming vulnerable to droughts. A notable example is the drought of 2004, which began a couple of years earlier and had grown into serious proportions in the year 2004. Dealing with drought requires a different strategy than that of dealing with the floods and typhoons that have been known in the Mekong region for years. The local communities, governments and NGOs are aware about how to deal with these age-old problems. However, being a slow onset disaster with crippling impacts, drought needs to be looked from a different perspective. This perspective is difficult to get in a region that has less experience of drought, and less local knowledge on how to deal with it. This could have catastrophic effects unless efforts are made to know and understand what drought means to this flood prone region.

This study, the collaboration between Oxfam in Vietnam, International Environment and Disaster Management (IEDM) laboratory of Graduate School of Global Environmental Studies (GSGES), Kyoto University, Japan and Peoples Committee of Ninh Thuan goes into some aspects of the recent droughts in the Mekong region and tries to find out what could be the reasons behind them and how best they could be mitigated. The study has come out with valuable observations on what communities perceive of drought, climate change and on how the local governments and NGOs could manage climatic disasters, particularly drought. It identifies that the drought impacts are in real sense a reflection of developmental problems and provides policy options that could be implemented by communities, governments and NGOs.

In this report, Chapter 1 forms the executive summary and Chapter 2 introduces the background of the work, objectives and aims. Chapter 2 also provides information on methodology, concepts adopted and an overview of study locations. We provided the overview of Ninh Thuan province in Chapter 3, giving the developmental context of the province. The fourth chapter on Disaster and Climate Change Vulnerability discusses the present status of various disasters and future projections of climate change. This chapter also makes interesting and contrasting observations on the climatic data between what communities perceived and what is presented. The actual results of the study are discussed in detail in Chapter 5. The policy options for dealing with drought risks are then presented in Chapter 6. This chapter also includes the recommendations of the National Forum on Community Based Adaptation to Drought in the Context of Climate Change. Chapter 7 gives a brief note on future directions for all those interested in drought risk mitigation based on this work.

Readers whose time is limited are suggested to read the preface, executive summary and introduction and then turn to chapters 6 and 7. Summary checklist tables of drought impacts and root causes can be found in tables 27, 28 and 29 and other charts in these chapters outline the subsequent suggestions and recommendations.

While this is an ongoing pilot work, we hope that it helps improve widespread understanding of the problem and help initiate developmental programs by bringing various stakeholders together. Any feedback is highly appreciated.

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Consultation with the other non-governmental organizations was also an important aspect of this work. We acknowledge the contributions of the Netherlands Red Cross and World Vision throughout the consultation process and in enriching the discussions during the final forum conducted in Ha Noi. We acknowledge the leadership provided by Dr Nguyen Dinh Ninh of Water Resource Department, Ministry of Agriculture and Rural Development. We also acknowledge inputs given by the Ministry of Natural Resources and Environment, Department of Planning and Investment, Department of Agriculture and Rural Development, and Department of Natural Resources and Environment at the national level. We thank the Phan Rang Centre of Hydrological and Meteorological and the Institute of Meteorology and Hydrology for providing necessary climatic data for this report.

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1. Executive Summary

During recent years, drought has become a common sight in most of the areas in the Mekong River Delta of the Mekong region including 9 provinces in the Southern Central and Central Highland regions in Vietnam. The Department of Water Resources, Ministry of Agriculture and Rural Development (MARD) has estimated nearly 1-1.3 million people as drought affected in these provinces, representing 13-17% of the total population, and hence are in need of assistance. Ninh Thuan province is the most affected among these provinces.

This project is part of the collaboration between International Environment and Disaster Management (IEDM) laboratory of the Graduate School of Global Environmental Studies, Kyoto University, Japan, Peoples Committee of Ninh Thuan, Vietnam and Oxfam in Vietnam. The current research focuses on the impacts of recurring droughts on the livelihoods of the rural communities in the drought-prone areas of Ninh Thuan province. The study also puts emphasis on finding the perceptions of local communities and government functionaries as to how far the drought related vulnerabilities could be traced to climate change at the global level.

We assessed the drought vulnerability of the rural communities in the most drought prone areas in Ninh Thuan province by identifying drought impacts on different livelihood sectors such as agriculture, animal husbandry, and fisheries. The impacts were ranked and root causes were identified based on which appropriate policy interventions are drawn. Due emphasis was given on the gender-disaggregated impacts and adaptation measures, wherever possible. At the end, a note has been provided on the future directions for various potential stakeholders in order to take forward the findings of the study.

The study revealed that the rainfall in Ninh Thuan province has actually been increasing over the time. However, there are indications of increasing inter-annual variability of rainfall as depicted by the increasing deviation from the long-term mean. This could be the main reason for the increasing incidence of drought rather than due to any decline in long-term rainfall. Another reason for increasing drought conditions is increasing demand for water. The province has witnessed a steady growth in the area under wet paddy cultivation, under maize and other perennial crops which need substantial water when compared with the dry rice grown during earlier years. The heavy reliance on groundwater has significantly led to saline water intrusion. The proliferation of aquaculture in many areas of Ninh Thuan province has further contributed to the drought problem.

Communities were well aware about climate changes happening around them, notably higher temperatures and erratic rainfall. They attributed the drought not only to decline in forest cover, which is corroborated by the declining forest cover in the province, but also to the bad environmental management practices elsewhere. Communities were of the opinion that the provision of better financial facilities and facilities which would help diversify their livelihoods would substantially reduce their vulnerability to climate related extremes. Discussions with government and non-governmental officials have corroborated these findings.

Policy options identified in participation with communities consist of better water use management strategies, both at the field as well as the basin/command level, and introduction of better crop management practices including enhanced irrigation efficiency and introduction of drought resistant crop varieties that use less water while not compromising the yield. The National Forum has recommended establishing dedicated Drought Management Boards at commune level on lines of the flood management boards, which have been successful. Such boards will not only enhance the response and relief operations but would also help identify and implement appropriate drought mitigation programs by understanding the local vulnerabilities.

2. Introduction

Climate change has brought new risks for humanity. It is important to understand the nature of these risks, where natural and human systems are most vulnerable, and what may be achieved by adaptive responses¹. Adaptation to climate change has the potential to substantially reduce many of the adverse impacts of climate change through enhancing the capacity of governments and communities to withstand the climate change impacts. While climate change adaptation has been discussed over several years past, including organizational response, little attention has been focused on community level adaptation, and integrating community adaptation methods at the policy level.

Since some of the worst sufferers of climate change are rural communities, whose livelihoods are dependant on agriculture, it is important to focus on the impacts of climate change on their livelihoods and re-establish the links among poverty, defined as stable purchasing power to maintain decent living, livelihood and environment. However, focusing on communities is not enough; so long as the community initiatives do not become part of the government policies it is difficult to sustain their efforts, which means that the emphasis should be from both ends. Perhaps the most important prerequisite for creating sustainable livelihoods and for achieving sustainable development is good and accessible government². Thus, the link between local, state, and national governments to the community is of utmost importance.

The research focuses on Ninh Thuan province. Rated the 59th poorest province of Vietnam, Ninh Thuan is one of the nine provinces that are most affected by drought. Drought is not a new phenomenon in Ninh Thuan; it has been a regular occurrence down the ages. But droughts are increasing - in number, duration and intensity during recent years. The province was severely affected by the major drought in August 2004 with reduction in rainfall by 50% of the normal. The drought has continued in 2005 and 2006 with poor rainfall during the first two cropping seasons. Prolonged dry days have caused significant damage to agriculture and changed the salinity of groundwater thus damaging aquaculture. The increasing drought events in Ninh Thuan province are a major concern for both the governments and local communities. A systematic study is needed to relate these changes with climate change and to understand what kind of preparedness mechanisms may be put in place to reduce the impacts of droughts. This research is a contribution to that process.

2.1.Aim and Objectives

2.1.1. Aim

The aim of this study is to understand the factor of climate vulnerability and to improve the resilience mechanisms through community based risk reduction planning in some of the most climate risk prone areas in Ninh Thuan province. This study is regarded as a pilot initiative to understand various issues related to climate change so that the focus areas of intervention in the climate risk prone areas can be identified and implemented.

¹ *Climate Change 2001: Impacts, Adaptation and vulnerability: Contribution of Working group II to the Third Assessment Report of the International Panel on Climate Change*

² *Sustainable Livelihoods: Kristin Helmore and Naresh Singh, 2001*

2.1.2. Objectives

The specific objectives to achieve the above aim are:

1. To assess the climate vulnerability of rural communities in the most drought prone areas of Ninh Thuan province, Vietnam. As a part of this activity, perception surveys were conducted to reveal the limitations posed by the perceptions of communities on the efficacy of activities being taken up by various intervening agencies.
2. To identify possible adaptation measures to mitigate the impacts of ever increasing climate variability and change, in terms of droughts, on rural communities with an emphasis on identification of gender-disaggregated impacts and adaptation measures. This objective is met through systematic use of 'How to reduce drought risk' tool developed by the Preparedness and Mitigation Working group of the Western Drought Coordination Council, USA.

2.2. Research Methodology

The project used a mix of vulnerability assessment methodologies due to the interdisciplinary nature of the problem. Much of the methodology has been drawn from 'How to Reduce Drought Risk' of Western Drought Coordination Council³, because it is a simple step-by-step process for users (Communities, local, provincial and national governments; NGOs and other institutions) to identify actions to reduce the impacts, and a combination of participatory rural appraisal techniques were used in the study.

2.2.1. Components

The Figure 1 depicts the components of the methodology. The methodology is based on the past impacts of the drought for the very reason that the impacts reflect well the local vulnerabilities of communities, institutions and governance mechanism.

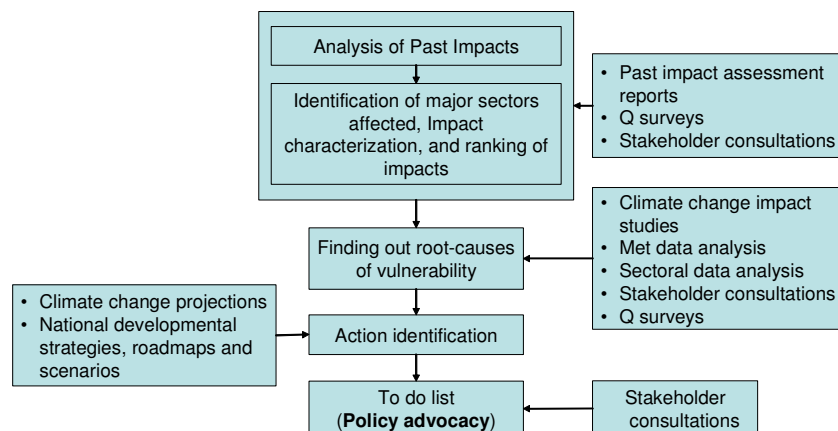


Figure 1: Components of the research methodology

Impact assessment

With impacts as starting point, the study further investigates into finding root causes for the impacts which could be institutional and sectoral inefficiencies, community vulnerability factors and those of climate. In areas where past impact assessments could not be obtained or sufficient

³ Knutson, C., Hayes, M and Phillips, T. 1998. How to reduce drought risk. Western Drought Coordination Council, National Drought Mitigation Center, Nebraska, USA.

information is not available, the information from the questionnaire surveys and group discussions were supplemented to the process. Due emphasis was given for the gender related issues.

Impact characterization

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

Finding root causes

The differential impacts or impacts per se are due to the root causes of vulnerability. The root causes could be lack of irrigation facilities, cultivation of susceptible crops and mismanaged cropping systems, dykes to stop floods and lack of coastal belt plantations etc. In order to find the root causes, discussions were made with communities, institutions and governments. Problem trees or impact trees were constructed based on the discussions and the root causes or underlying factors were identified.

Action identification

Appropriate actions were identified based on the above analysis. This was done through developing a matrix which lists the impacts and root causes of the impacts (vulnerabilities). Action identification also considered the possible mitigation of climate change impacts. The actions were classified as mitigation, response, and preparedness actions based on how they fit in the risk management cycle.

Policy advocacy

While this study stops at the stage of action identification, the policy advocacy or preparation of a to-do list is a stage when all the stakeholders should sit together and discuss about the outcomes of the above analysis. We suggest that the stakeholders sit together and prioritize the actions to be taken based on the resources available. This part has been dealt briefly in the section on 'Future Directions'.

2.2.2. About study locations

Four villages in two communes, from 2 different districts, were identified in Ninh Thuan province. The Table 1 and Figure 2 provide information on study locations.

Table 1: Study locations

Country	Province	Districts	Communes	Hamlet
Vietnam	Ninh Thuan	Ninh Phuoc	An Hai	<ul style="list-style-type: none"> • Long Binh • Hoa Thanh-Nam Cuong
		Bac Ai	Phuoc Thanh	<ul style="list-style-type: none"> • Da Ba Cai • Ma Ro

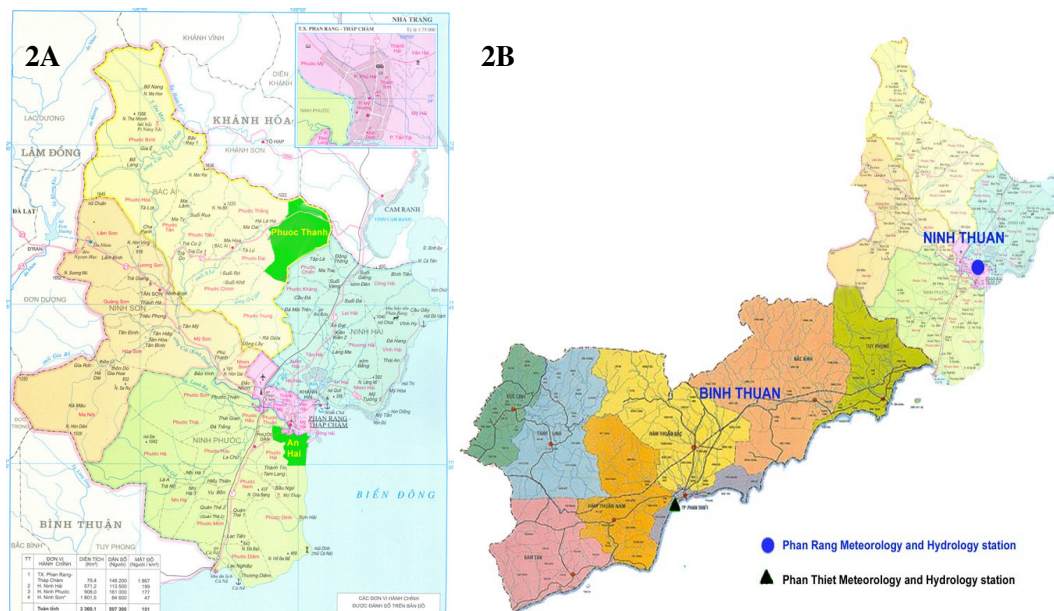


Figure 2: (a) Map showing the location of study villages in Ninh Thuan Province, (b) Map showing the location of hydro-met stations from where the climatic data was obtained

An overview of Phuoc Thanh commune

Located on the North-West of Ninh Thuan province, Phuoc Thanh is one of the mountainous communes with 10,086 ha area. It has a forest cover of 7,667 ha and agricultural area of 9,117 ha. The commune has a population of 2,649 living in 527 households and 5 hamlets. There are 2547 (96.2%) Reglays (ethnic communities) and 102 (3.89%) Kinh communities. The main livelihood of the people is agriculture. They grow rice, maize, cassava and cashew. Their secondary livelihood is animal husbandry and they grow cattle and goats. Communities do not have much area under forests and hence are planting and protecting the State's forest in various programs. Due to poor conditions and shifting cultivation, the State's forests are usually affected by negative impacts of human activities. Most households are poor and food scarcity is common. According to the data of People's Committee of Phuoc Thanh commune, there were 193 (36.6%) poor households in 2005.

An overview of An Hai commune

An Hai is one of the coastal communes located on the East of Ninh Thuan province. The commune has 1,057 ha under agriculture, 4,239 ha under forestry, 4,833 ha under dwelling and the rest of the area is under aquaculture and other uses.

Total population of An Hai commune is 12,890 living in 2,596 households in 6 hamlets in 2005. The main livelihood of communities is agriculture with main crops of rice, grape and short-duration vegetables such as tomato, carrot, chilli and potato. Animal husbandry is one of the strengths of An Hai commune as they rear cattle, sheep and goats. Located along the 1A highway and near by Phan Rang – Thap Cham town, the An Hai commune has developed small scale trading. Aquaculture has been very much developed in the past 5 years in this commune. Nowadays, due to diseases and water pollution, the area under aquaculture has been decreasing. According to the data of People's Committee of An Hai commune, there were 521 (20.7%) poor households in 2005.

2.2.3. Overview of respondents

Community respondents

The Table 2 provides an overview of respondents. It can be discerned that majority of respondents are farmers, irrespective of the study location. However, a small difference could be observed between coastal region and mountainous region with major proportion of the later owning the land than the earlier. The majority of respondents are young (67.5 %) with a sex ratio little more than 1.7 males/female.

Table 2: Overview of the community respondents (Numbers are in percentages)

S No	Parameter	Coastal Region		Mountainous Region	
		Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
1	Occupation				
a	Farmers	83.3	65.4	92.0	100.0
b	Landless laborers	6.7	19.2	4.0	0.0
c	Artisans	6.7	7.7	4.0	0.0
d	Traders	3.3	7.7		
2	Gender				
	Male	65.0	57.7	68.0	59.3
	Female	35.0	42.3	32.0	40.7
3	Age group				
	Young (20-50)	73.3	65.4	72.0	59.3
	Old (>50 years)	26.7	30.8	28.0	40.7

Government and mass organizations

The profile of respondents is given in Table 3. A total of 20 officials of government and mass organizations were interviewed by using structured questionnaires and personal interviews.

Table 3: Profile of respondents representing government and mass organizations in Coastal and Mountainous study regions

S No	Administrative boundary	Affiliations/Departments	Number of respondents
1	Commune	<ul style="list-style-type: none"> • Young association • People's Committee • Women Association • Farmer association 	9
2	District	<ul style="list-style-type: none"> • People's Committee • Department of Economics and Agriculture • Department of Animal Husbandry • Department of Natural resources and Environment • Department of Statistics 	6
3	Village	<ul style="list-style-type: none"> • Village Leaders 	5

2.2.4. Data collection procedure

Various participatory rural appraisal techniques including structured questionnaire surveys, meetings, focused group discussions and transect walks to familiarize with the local conditions were used in the study. Interviews and group discussions were conducted with the elected commune leader/s, commune, district and provincial level authorities, officers of the Department of Meteorology, Department of Agriculture and Rural Development, Department of Animal

Husbandry, Department of Water Resources and 2 leading NGOs active at study locations (ACTION AID and Red Cross).

At the Provincial Level, individuals were interviewed and secondary data was collected from the representatives of Provincial People's Committee, the Planning and Investment Department, the Department of Agriculture and Rural Development, the Department of Natural Resources and Environment, and the Center of Meteorology and Hydrology.

At the District Level, individuals were interviewed and secondary data was collected from the representatives of District People's Committees, the Department of Economics and Agriculture, the Women's Union and the Action Aid (NGO).



Figure 3: Training field volunteers in implementing the survey

At the Commune Level, individual interviews were conducted and secondary data was collected from the representatives of Commune People's Committees, the Youth Union, the Farmers' Associations and the Women's Union.

At the Village Level, interviews were conducted with the village heads, Managing Board members of the village, and households. Livelihood sector ranking exercises were carried out.



Figure 4: Finding root-causes of drought in a focused group discussion

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

Workshops, forums and stakeholder consultations

To obtain information on drought impacts, difficulties faced while managing droughts, and innovative solutions to overcome the problems, two workshops and one national forum were organised. Two workshops were organised with the participation of Department of Irrigation (MARD), Meteorological and Hydrological Institute (MoNRE), Oxfam GB, Red Cross and World Vision in Hanoi, Vietnam. The National Forum was organised by Oxfam GB, Red Cross and MARD with the participation of 80 persons from 8 provinces and different organizations. Consultation with Oxfam's Humanitarian and Livelihood Programme staff helped in fine-tuning the work especially in the areas of gender, impact assessment and drawing policy suggestions.



Figure 5: Interviewing a member of Peoples Committee of a commune

3. An Overview of Ninh Thuan Province

Ninh Thuan is located in the farthest South of the Central Vietnam with coordinates of 11°18'14" to 12°09'15" North latitude and from 108°09'08" to 109°14'25" East longitude bordering Khanh Hoa at the North, Binh Thuan at the South, Lam Dong at the West and East Sea at the East. The province has a total area of 3,358 km² with 105 km of coastline. The geography is characterized by plain, mountain (with ranges surrounding the province) and coastal areas. The diversified terrain slopes to the east, towards the sea. The capital, Phan Rang, is at the centre of the province. There are five districts: Thuan Bac, Ninh Hai, Ninh Phuoc (coastal plain districts) and Ninh Son, Bac Ai (mountainous districts).

3.1. Topography

The province is surrounded by the mountains on the 3 sides. The topography slopes from the West to the East and Northwest to the Southeast. The high mountain areas occupy 60% of the total geographical area. There are 8 mountains with the height more than 1000 m; 6 mountains in Bac Ai and 2 mountains in Ninh Hai districts.

3.2. Meteorology and Climate

Ninh Thuan is one of the most drought-ridden and hottest areas in the country. The Truong Son mountain range is situated such that it obstructs the wind throughout the year. The province has the lowest average rainfall in the country. Some storms and floods occur in October and November. The terrain is an enabling factor for storms to become highly damaging - characterized by heavy rains and floods and with harmful impacts on crop production and livelihoods.

Ninh Thuan province is the hottest province of Vietnam with the average temperature of about 27 °C. The highest temperature recorded was 40.5 °C at Nha Ho station in 1937. The lowest temperature recorded was 14 °C at Nha Ho station in 1964 and 14.4 °C at Phan Rang station in 1931. There are two seasons: the rainy season that starts from July to November and the dry season that starts from December to June. Normally, the amount of rainfall received is different between the mountainous and the coastal regions. The annual rainfall in the coastal town of Phan Rang – Thap Cham is 712 mm, 1,071 mm in Tan My and 1,659 mm in Song Pha. The rainfall can reach 2,200 mm/year in the upstream. The rainy season is strong during the three months of September to December.

3.3. Socio-economic Conditions

3.3.1. Population

Ninh Thuan is one of the provinces in Vietnam which has a population density (167 persons/km²) lower than the national average (252 persons/km²). It recorded a population of 564,403, with 279,097 (49.5%) males and 285,306 (50.5%) females, in 2005. The fertility rate has been decreasing from 38.3 % in 1992 to 20.6% in 2005; though the population continued to increase. The mortality rate decreased during 1992-2004 and increased again in 2005. The population growth has put additional demand on the environment and natural resources.

There are 28 ethnic groups in Ninh Thuan province. Majority of the population in Ninh Thuan is represented by Kinh, Cham and Reglay communities. According to the census data of 1999, there

were 57,100 (11.3%) and 47,600 (9.4%) Cham and Reglay communities distributed in costal and mountainous regions respectively.

3.3.2. Health services

There has been reasonable development of health services in the province, recently. The number of beds and medical staff have been increasing though are still not enough (feedback from the local communities).

Table 4: Health service infrastructure in Ninh Thuan province

Number of health establishments	2001	2002	2003	2004	2005
Hospitals, clinics, sanatoriums etc	76	78	73	72	74
Number of sick-beds	1,085	1,154	1,145	1,165	1,294
Total health staff	1,289	1,337	1,324	1,289	1,299

3.3.3. Education

The education facilities in the Ninh Thuan province have also shown rapid development, along with the population growth.

Table 5: The development of education facilities in Ninh Thuan province

Number	2001	2002	2003	2004	2005
School	168	175	181	194	198
Classes	3,604	3,754	3,837	3,871	3,877
Teachers	4,567	4,750	4,999	5,139	5,231
Students	122,834	126,444	126,696	128,607	126,138

3.4. Main Livelihoods



Figure 6: Maize cultivation provides an assured income to the rural population in this part of Vietnam

Accounting for 50% of the province's GDP, agriculture employs over 70% of the labor force. Main agricultural crops grown are rice, maize and peas. Recently, in the coastal areas, the aquaculture industry (shrimp farming) has emerged with some remarkable initial benefits. Rearing of drought resistant sheep breeds and growing grapes are on the rise during recent times.

There has also been expansion in maize cultivation because of its versatility and low water requirements when compared with the crops such as wetland rice.

3.4.1. Agriculture

Main crops of Ninh Thuan province are rice, maize, peas, grapes and short-day crops such as tomato, carrot, and potato. The agriculture sector plays a very importance role in the economic development, food supply and livelihoods of most of the population of Ninh Thuan province. There has been a change in the area under paddy due to growing population, economic development and increasing demand for food. The area under paddy cultivation had increased from 28,713 ha in 1992 to 33,852 ha in 2004. In 2005, due to drought, the area under paddy cultivation was reduced by 50%. Along with paddy, maize is a very important crop for the people of Ninh Thuan in general and Reglay communities, who live in mountainous areas, in particular. Maize is the secondary food source for the people here. Due to recent droughts, some of the paddy area has been converted into maize cultivation (Figure 7). As a result, the production of maize has grown several multiples since 1990s.

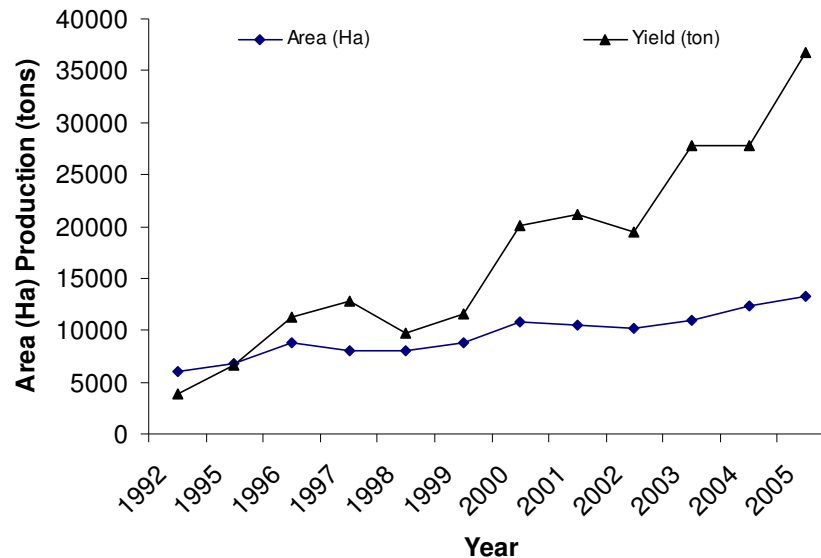


Figure 7: The area (ha) and production (tons) of maize in Ninh Thuan province since 1992

3.4.2. Animal Husbandry

Farmers in Ninh Thuan province raise mixed flocks of goat and sheep. They keep large herds on small farms at a low cost by integrating their production with neighbouring farms. The animals are fed on cut-and-carry basis during the wet (cropping) season. Most farmers grow Napier grass for cutting or some other type of improved pastures. They also grow tree legumes such as Gliricidia, which provide forage and add nutrients to the soil.

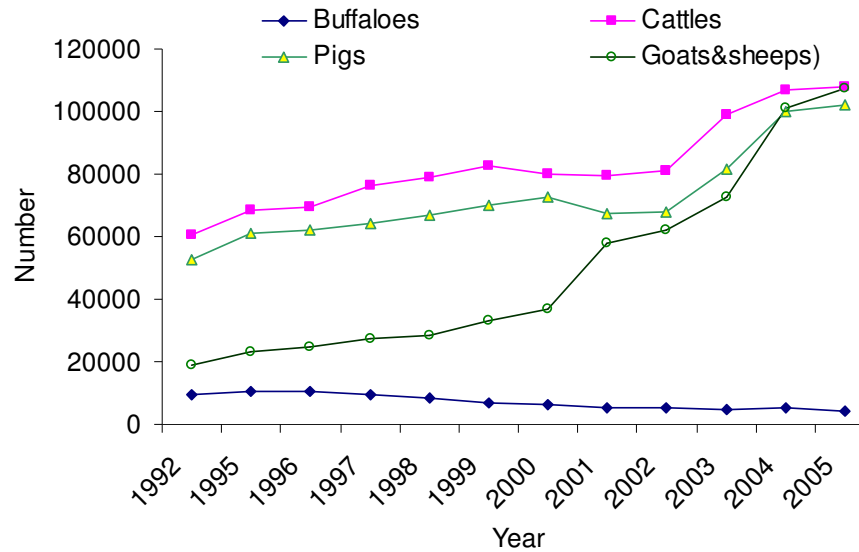


Figure 8: The change in number of domestic animals in Ninh Thuan province since 1992

The animals graze on fallow land of neighbouring farms as farmers are happy to let them graze in their fields during the dry season. The herds help keep down weeds and fertilize the soil with the droppings. Some farmers sell the manure to fruit and vegetable farms in the upland areas. The Sultan breed of sheep from India, which is tolerant to high temperatures, is the most preferred breed in the province. They are bred for their meat and not for their wool and hence do not need shearing. Most farmers keep mixed herds of sheep and goats. There is a good market demand for both sheep and goat meat, which sell at the same price. Cattle are also one of the priority animals and contribute to the livelihoods of communities.

Poultry is also an important livelihood activity for communities. Almost all the households keep poultry birds as it provides a regular source of proteins and income. However, recently, the number of poultry has been decreasing due to bird flu.

3.4.3. Forestry as a source of livelihood

Ninh Thuan province had a forest area of 147,536 ha in 2005 comprising of 139,657 ha of natural forest area, 7,879 ha of planted forest, 768,634 ha of bald hill and 111,606 ha under others. There had been some changes in the forest area during recent years. Though the forest cover seemed high (43.9% in 2005), the forest density had decreased due to excessive illegal deforestation and severe drought induced forest fires.

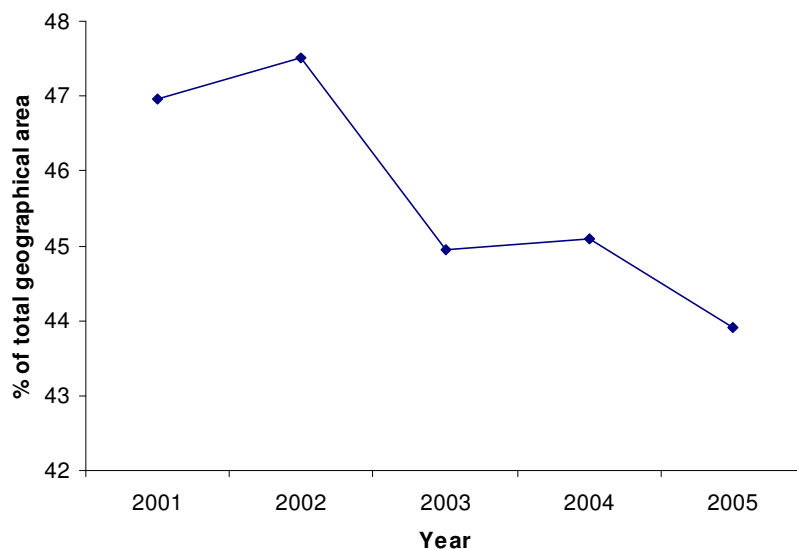


Figure 9: The percent of area under forests in Ninh Thuan province during recent years

3.4.4. Fisheries and Aquaculture

Ninh Thuan has a coastline of 105 km covering 18,000 sq km including the three seaports of Dong Hai, Ca Na, and Khanh Hai. Ninh Thuan territorial waters are one of the four biggest fishing grounds supplying significant seafood to the country. The province also has lot of potential for developing tourism and fishing industry. The sea near Ninh Thuan has over 500 kinds of fishes and shrimps including read snapper, grouper, mackerel, tuna, prawn, and squids. The total fish and shrimp reserves amount to 120,000 tons.



“We got good income from shrimp cultivation during 2000-2003. Since 2004, we suffered losses due to lack of enough fresh water for managing the shrimp ponds. We are in severe debt to the bank.”

*Nguyen Van Thinh,
Villager of Hoa Thanh
hamlet*

Figure 10: The coastal fisheries have mushroomed in the drought prone province putting more stress on already scarce water resources

The area under aquaculture reached 1,591 ha in 2004 due to the expansion of lagoons, bays, and big sandbars which are convenient for making salt. Big scale aquaculture is concentrated in Nai

lagoon, Ca Na, Vinh Hy etc. The area had decreased in 2005 due to droughts, diseases and declining profits. Pollution of water has also contributed to the decline in the area.

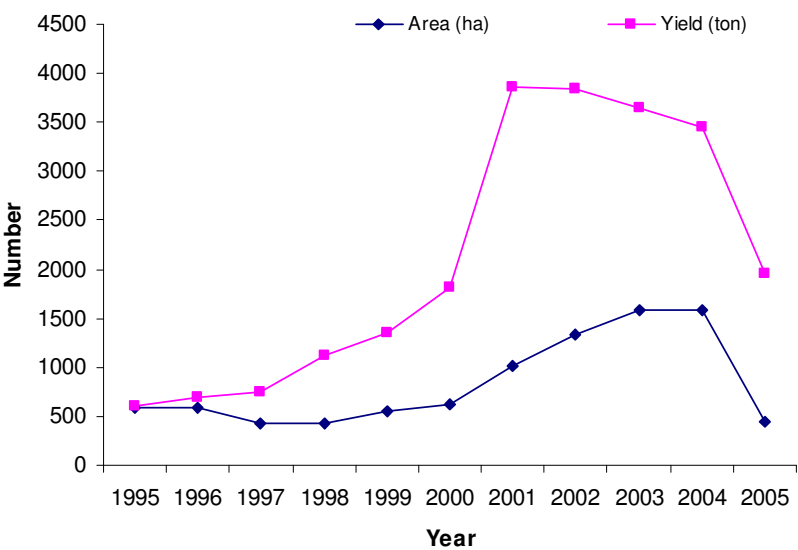


Figure 11: The change in area (ha) and yield (tons) of shrimp over the years

4. Disaster and Climate Change Vulnerability

4.1. Disaster Vulnerability

4.1.1. Droughts

The fluctuations in the time and duration of occurrence of rains are the reasons for prolonged droughts affecting socio-economic conditions in Ninh Thuan province. The Table 6 shows the impact of recurring droughts on various sectors. The Table shows that the drought which started in 2002 had persisted till the end of 2004 making 2004 as the most severe drought year. The 2004 drought was considered to be a historical drought with severe impact on the socio-economic conditions in the province. During this year, the irrigated area was reduced by 5,000 ha. This phenomenon was unknown to the governments and communities and caught them unawares. Lack of preparedness and lack of local knowledge in dealing with the persistent droughts has even exacerbated the situation.

The part of the drought vulnerability of Ninh Thuan province could be attributed to lack of adequate surface and subsurface water resources and declining irrigation capacity of the irrigation infrastructure facilities. Analysis of the available irrigation facilities reveals this fact. The total designed irrigation capacity of 6 irrigation reservoirs and 76 small dams in the province is 25,229 ha. However, they could only irrigate 16,573 ha (66%) as indicated in the Table 7 and 8.

“The Central Government had built Song Sat dam and reservoir to provide water for 4 communes in Bac Ai district but we don’t have enough capacity to build the secondary canals to bring water from the reservoir.”

Nguyen Van Tuan, Vice Chairman of People’s Committee of Bac Ai

Table 6: Impact of past droughts on different sectors

Sectors	Unit	2002	2003	2004
1. Areas of Agriculture land effected by drought	Ha	4,400	2,909	5,185
Paddy	Ha	750	607	1,241
Other Crops	Ha	3,650	2,302	3,944
2. Loss of planted forest	Ha	730	NA	1,200
3. Areas of aquaculture effected by drought	Ha	600	500	NA
4. Number of people needing water	Person	138,823	45,000	150,000
5. Number of people needing food		26,886	72,405	184,115
6. Number of livestock needing water	heads	150,000	70,000	230,000
7. Economic damage	Billions VND	138	30	140

Table 7: Area (ha) under irrigation reservoirs in Ninh Thuan province

Name of reservoirs	Location	Areas (km ²)	Design Area (ha)	Current command area (ha)
1. Tan Giang	Ninh Phuoc	148.3	3,000	1,400
2. Thanh Son	Phan Rang	17.5	250	140
3. Suoi Lon	Ninh Phuoc	8.0	125	35

Name of reservoirs	Location	Areas (km ²)	Design Area (ha)	Current command area (ha)
4. CK7	Ninh Phuoc	30	100	110
5. Song Sat	Bac Ai	137.0	3,510	Under constructing
6. Bau Ngu	Ninh Phuoc	21.5	160	Under constructing
Total			7,145	1,685

Table 8: Area (ha) under 76 small dams in Ninh Thuan province

Name of dams	Location	Areas (km ²)	Design Area (ha)	Current command area (ha)
19/5	Ninh Son	32	300	200
Song Ong	Ninh Sin	30	3,200	2,000
Tra Co	Bac Ai	60	50	45
Ma Noi	Bac Ai	33	63	40
Nha Hui	Bac Ai	25	300	300
Nha Trinh	Ninh Hai, Phan Rang and Ninh Phuoc	2,140	12,800	11,515
Tuan Tu	Ninh Phuoc		250	180
30 other dams	The whole province		621	358
Underground water facility	The whole province		500	250
Total			18,084	14,888

There is a big gap between water demand and water supply in Ninh Thuan province. The capacity of irrigation systems could only satisfy 33% of the demand.

In addition to this irrigation and water infrastructure, water supply systems have also been established to provide piped water supply to the urban and rural areas. With the current water supply systems, each person in cities could get a water supply of 80 l/day. Due to the policy of the Central Government on clean water supply for rural areas, the provincial governments, NGOs and districts have built number of groundwater systems supplying 50m³/day to 500m³/day of water to rural areas. This enabled nearly 46% of the rural population to get clean water in 2004.

Table 9: Piped water supply for city and rural areas

Water works	Number of projects	Water source	Capacity (m3)
1. Urban Waterworks	3		14,000
Thap Cham	1	Cai River	12,000
Phuoc Dan	1	Underground water	1,000
Tan Son	1	Ong River	1,000
2. Water supply for rural areas	39		6,915
Ninh Phuoc	11	Groundwater	1,869
Ninh Hai	14	Ground water	2,436
Ninh Son	5	Ground water	1,945
Bac Ai	9	Ground water	665

4.1.2. Floods

According to the Floods and Storm Management Board, Ninh Thuan province is also vulnerable to floods. The Table 10 provides an overview of impacts of recurring floods on Ninh Thuan province.

Table 10: Impacts of Flood on Ninh Thuan Province

Sectors	Units	1998	1999	2000	2003
1. People died	People	30	1	11	15
2. Houses collapsed	Houses	10,614	438	7,859	23,000
3. Class rooms damaged	Rooms	27	3	143	137
4. Boats sunk	Boats	9		5	22
5. Area flooded	Ha	13,094	3,083	7,082	15,591
Paddy	Ha	7,034	2,241	3,988	9,190
Other crops	Ha	4,012	552	2,199	4,886
Garden	Ha	2,048	290	895	1,515
Other trees	Ha	4,012	550	1,324	4,765
6. Animals died	Heads	1,085	550	27,000	45,644
7. Irrigation systems damaged	Projects	18	15	17	50
8. Roads damaged	Projects	85	8	73	170
9. Aquaculture	Ha	100	10	64	1,059
10. Economic damage	Billion VND	133.4	7.1	122.4	191.0

4.1.3. Storms

Storms caused by low atmospheric pressure often occur during October to December. On an average, less than 1 storm event occurred in Ninh Thuan province per year (one in three years). Years 1968 and 1995 recorded 2 and 3 storms respectively which are considered as the most storm affected years in the history of Ninh Thuan.

4.2. Climate Change Vulnerability

Ninh Thuan province was formed in the year 1991 and the Meteorological station established at Phan Rang has started recording temperature from 1993. For this study, the temperature data was obtained from Phan Thiet meteorological station (source: Institute of Meteorology and Hydrology, Hanoi) while the rainfall data was obtained from the Phan Rang station (source: Center of Meteorology and Hydrology, Ninh Thuan Province). The graphs below show the long-term trend of annual total rainfall and mean minimum and maximum temperatures. Please refer to Figure 2b for the location of hydro-met stations.

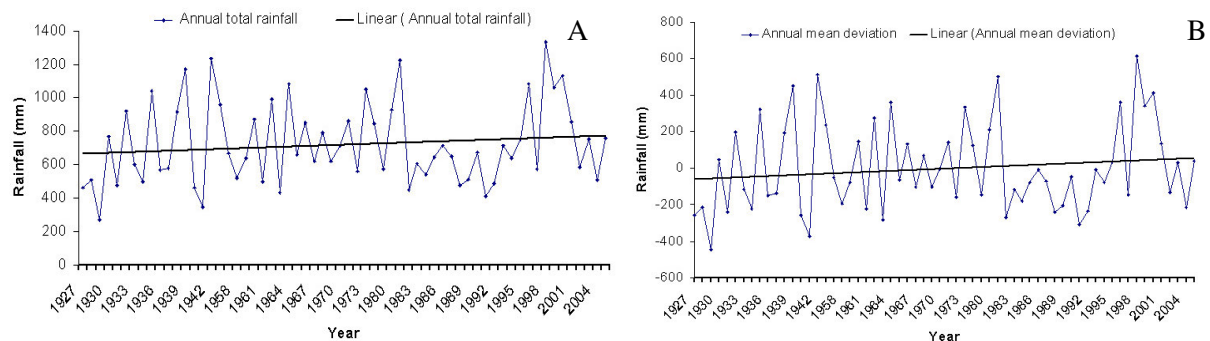


Figure 12: Annual total rainfall (A) and mean deviation of annual total rainfall (B) recorded at Phan Rang station in Ninh Thuan province

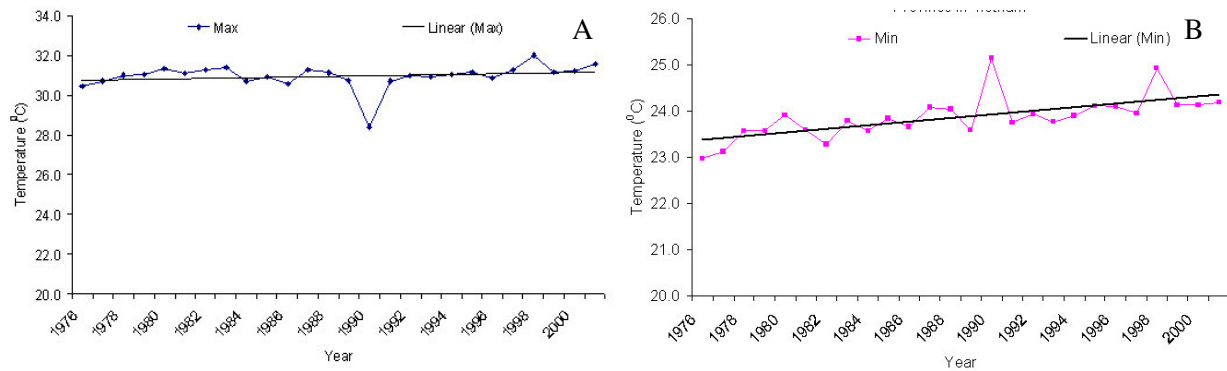


Figure 13: Mean annual maximum (A) and minimum temperatures (B) recorded at Phan Thiet in Binh Thuan province

The long-term data indicated an overall increase in the rainfall, and the mean annual minimum and maximum temperatures. Though the increasing rainfall may appear to be a favorable phenomenon to some extent, caution is required in reading the data presented here. The Figure 12B indicates a steady increase in the deviation of annual rainfall from the long-term mean. The figure also shows large difference between years which is an indication of the high rainfall variability. Such a large variation in the rainfall could mean droughts and floods if the surface water resources and rainwater are not managed appropriately.

The Figures 13A and 13B show changes in mean annual maximum and mean annual minimum temperatures indicating a steady increase since 1978. The slope of the minimum temperature is much higher than the maximum temperature indicating warming nights over the years. This means that more transpiration even during the nights and hence higher water demand by the crops.

The simulation experiments conducted by the Ministry of Natural Resources and Environment, Vietnam (2003) indicated that the South of the South Central Vietnam will receive increased rainfall to the tune of +5% of the long-term average (Table 11). This means continuation of the past trend. Under these circumstances, it is clear that the inter-annual rainfall variability becomes more important in the sustainability of this region and that the relevant management practices may be taken up to deal with the risk.

Table 11: Climate change simulations for Vietnam⁴

Factors	Region	Season	2010	2050	2070
Temperature is increasing	Northwest, Northern of North		0.5	1.8	2.5
	Northern plain		0.3	1.1	1.5
	North of Central		0.3	1.1	1.5
	Middle of Central		0.3	1.1	1.5
	South of Central		0.3	1.1	1.5
	High land		0.5	1.8	2.5
	South		0.3	1.1	1.5
Rainfall is increasing (+) or decreasing (-) (%)	Northwest, Northern of North	Rainy	0	0 to +5	0 to +5
		Dry	0	-5 to +5	-5 to +5
	Northern plain	Rainy	0	0 to +5	0 to +5
		Dry	0	-5 to +5	-5 to +5
	North of Central	Rainy	0	0 to +10	0 to +10
		Dry	0	0 to +5	0 to +5
	Middle of Central	Rainy	0	0 to +10	0 to +10
		Dry	0	0 to +5	0 to +5
	Northern part of South Central	Rainy	0	0 to +10	0 to +10
		Dry	0	0 to +5	0 to +5
	Southern part of South Central	Rainy	0	0 to +5	0 to +5
		Dry	0	-5 to +5	-5 to +5
	Central Highland	Rainy	0	0 to +5	0 to +5
		Dry	0	-5 to +5	-5 to +5
	South	Rainy	0	0 to +5	0 to +5
		Dry	0	-5 to +5	-5 to +5
Sea level rise (cm)	All coastal line	-	9	33	45

⁴ Initial National Communication, Ministry of Natural Resources and Environment, Socialist Republic of Vietnam, Ha Noi, 2003.

5. Disaster and Climate Change Perceptions

This section discusses the results of questionnaire surveys of both communities and government officials. For the community responses, gender disaggregated data is presented wherever possible.

5.1. Communities

5.1.1. Disasters and their trends

At all locations, respondents ranked droughts and floods as the first and second most prevalent primary disasters respectively at their locations. The survey revealed that the most prevalent secondary disaster is spread of infectious diseases which are reflection of deficiencies in the post-disaster response mechanisms.

Table 12: Ranking of disasters at study locations (Percentage of respondents)

S No	Parameter		Coastal Region		Mountainous Region	
			Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
1	Most prevalent disaster I	Drought	85.0	100.0	100.0	100.0
2		Storm	15.0	0.0	0.0	0.0
3		Flood	0.0	0.0	0.0	0.0
	Most prevalent disaster II	Drought	15.0	0.0	100.0	0.0
		Storm	15.0	0.0	0.0	100.0
		Flood	85.0	100.0	0.0	0.0

Respondents could identify changes in disasters at all locations occurred in the past 30 years. They reported that the droughts are getting prolonged due to increasingly scanty rainfall. There is also a shift in the flood season with floods happening later than usual.

Table 13: Disaster trend in the past 30 years

S No	Parameter	Coastal Region		Mountainous Region	
		Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
1	Prolonged drought	81.7	61.5	20.0	100.0
2	More flood events	10.0	3.8	0.0	0.0
3	More storm events	0.0	3.8	0.0	0.0
4	Flood season comes later	5.0	3.8	32.0	0.0
5	Reduction in rainfall	0.0	15.4	48.0	0.0
6	Cannot say	3.3	11.5	48.0	0.0

The reason for the change in disaster trends is not clearly known to communities. However, respondents attributed the impacts to bad environmental practices elsewhere (36.7%) rather than within their own community (14.3%). (Only respondents in Ma Ro believed that the observed changes are due to bad practices within their community (25.9%) rather than the practices elsewhere (14.8%)).

5.1.2. Disaster impacts

Recurring disasters had multiple impacts on communities. The impacts identified by communities are listed in Table 14. The impact on crops and animals was identified as the most important. The loss of income, which is a cumulative effect of impact on cropping and animal husbandry, was

ranked third at most of study locations. Impact on availability of fodder and children's education has also emerged as significant.



“I am well but not happy. Our harvests are much smaller than usual. My family used to get about 3 quintals of rice but we only got 50 kg per season in the last 2 years. The drought has started from April 2004 and since then everything has dried up.”

Le Xuan Tri, Hoa Thanh hamlet

Figure 14: Recurring crop failures due to severe droughts is a cause for concern

Table 14: Impacts of the most prevalent primary disaster on the households

Impact	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
1	Crop failure	Crop failure	Crop failure	Crop failure
2	Losses in animal husbandry	Losses in animal husbandry	Losses in animal husbandry	Losses in animal husbandry
3	Loss of income	Loss of income	Impact on the health	Loss of income
4	Lack of fodder for cattle	Impact on the health	Death of garden and forest trees	Death of garden and forest trees
5	School dropout of the children	School dropout of the children	Loss of jobs	Loss of jobs

The responses by both genders were segregated and tabulated in Table 15. Both gender agreed on many drought impacts presented below.

Table 15: Top five ranked impacts of drought on the households (Gender disaggregated data)

Impact	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Males	1. Unprofitable aquaculture 2. Unprofitable animal husbandry 3. School dropouts 4. Loss of jobs 5. Lack of feed for animals	1. Failure of crops 2. Unprofitable animal husbandry 3. Lower income from animal produce 4. Loss of income 5. School dropouts	1. Failure of crops 2. Unprofitable animal husbandry 3. Loss of income 4. Death of vegetation 5. Loss of jobs	1. Failure of crops 2. Unprofitable animal husbandry 3. Loss of income 4. Death of vegetation 5. Loss of jobs
Females	1. Unprofitable agriculture	1. Failure of crops 2. Loss of income	1. Failure of crops	1. Failure of crops 2. Unprofitable

Impact	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
	2. Unprofitable animal husbandry 3. Lack of feed for animals 4. Health losses 5. School dropouts	3. Unprofitable aquaculture 4. Loss of jobs 5. School dropouts	2. Unprofitable animal husbandry 3. Lack of fodder for animals 4. Decline in water resources 5. Loss of income	animal husbandry 3. Death of natural vegetation 4. Loss of income 5. Loss of jobs

Drought Impacts at the Community Level

The following impacts were identified by the National Forum conducted in Hanoi:

Livelihoods

1. Lack of fodder, drinking water for cattle, for irrigation purposes and industries
2. Reduced crop yield and quality
3. Impaired productivity of forest land
4. Land degradation
5. Damage to fish farming

Food security

1. Loss of availability of food
2. Loss of availability of nutritious food

Health

1. Dependence on unsafe drinking water sources
2. Insufficient water for hygiene purposes
3. Stress due to loss of livelihoods and income

Economic impacts

1. Loss of income from agriculture and fishery
2. Loss of employment
3. Increased prices of food and fodder

Social impacts

1. Migration and related impact on families/communities and on social structure
2. Loss of human life
3. Increased inequity among social groups
4. Increased conflicts
5. Increased mental & physical stress
6. Increase in crime rate
7. Reduction in school attendance
8. Increase burden on women and children
9. Increase burden on Government and Non Government Organizations

Environmental impacts

1. Increase in deforestation, partially due to forest fires
2. Environmental pollution
3. Extinction of endangered species and loss of bio-diversity

Impacts on different genders, age groups and livelihoods

The drought impact on women and children need to be emphasized. Women in these communities collect water from nearest water source, the distance of which often gets prolonged

in each drought; do work such as cooking and cleaning, rear children, and collect firewood. In addition, they also work in agricultural farms earning income for their family. Women in these communities have fewer skills to be able to work in less burdensome jobs. This means enormous physical burdens on them on daily basis. The situation worsens during droughts. With fewer water sources near the dwelling, they will have to walk long distances to fetch drinking water.



“My children had to dropout of school to help me in collecting drinking water from the stream very far from our house.”

Ca To Thieu, Villager of Ma Ro hamlet

Figure 15: Interviewing female respondents: exploring the gender differentiated impacts

Recurring disasters had differential impacts on different genders. On an average, 63% of respondents agreed that there are differential impacts of disasters on different genders of the society. 74% of respondents believed that the women were more impacted by the drought than the men. The percentage of respondents who reported higher impact on females was higher in Hoa Thanh-Nam Cuong (91.7%) than at other locations. Differential impacts of the drought on different genders were due to differential water needs of genders itself, respondents opined. Water scarcity makes women walk long distances to fetch water. The survey also reiterated the fact that old members of the society and children are much more vulnerable to the drought. These impacts were attributed to the prevalence of heatwaves and malnourishment during drought.

Table 16: Does drought has differential impacts on different genders?

S No		Coastal Region		Mountainous Region	
		Males	Female	Male	Female
1	Yes	50.3	53.6	74.6	59.7
2	No	49.7	46.4	25.4	40.3

Respondents believed that farmers are more affected due to drought than any other section of the society. The response was uniform throughout study locations. This signifies the fact that the primary impact of the drought is on crops. Due to insufficient water resources, both surface and subsurface, crops often face hydrological drought. Rural artisans were ranked the second most impacted after farmers. It indicates the declining purchasing power in rural areas, which in turn affect the much-needed economic activity to keep up the secondary rural livelihoods, such as those of rural artisans.

Largely, there was an agreement between different genders on gender-differentiated impacts of the drought. However, a higher difference of opinion was found in the mountainous region where more males (74.6%) than females (59.7%) believed that the drought has differential impact on different genders.

Table 17: Vulnerability of different sections of society to drought impacts (gender disaggregated data)

Respondents	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Males	All are vulnerable	All are vulnerable	All are vulnerable	Men
	Old persons	Old persons	Children	Old persons
Females	All are vulnerable	All are vulnerable	All are vulnerable	Women
	Old persons	Old persons	Children	Old persons

The above table provides information on what different genders perceived about the vulnerability of different sections of the society to drought. There was an agreement on the vulnerability of all to the drought with old persons and children being more vulnerable. Surprisingly, the male respondents from Ma Ro identified that males are more vulnerable than others most probably due to the failure of crops, loss of jobs and income (Table 17). They believed that women had no economic activity and hence had nothing to lose due to the drought.

Increase in health problems in women:

Unhygienic conditions and drought go hand in hand in study areas. Due to insufficient water to bathe, many women either do not bathe or bathe sparingly leading to hygiene related health problems. For example, if it is any indicator of the above fact, the percentage of women affected by gynaecological diseases has increased from 57% in 2004 to more than 60% in March 2005 across the province while in the Bac Ai and Ninh Phuoc districts it was 55% and 61% (2004), respectively (source: Oxfam's assessment report conducted in 2005).

Increase in the prevalence of diarrhoea among the children:

According to the statistics of Provincial Health Centre, 1,304 cases were reported with diarrhoea in the whole province, an increase of 4.9% compared with normal levels due to water scarcity and unhygienic conditions. Often, hygiene practices such as washing may have been reduced due to water scarcity. Boiling water was not a prevalent practice as it was never necessary before or due to scarcity of firewood (Source: Oxfam's assessment report conducted in 2005).

5.1.3. Vulnerability trends

Communities believed that they are increasingly becoming vulnerable to natural disasters such as droughts and floods (77.3%). The percentage of such believers was higher in the coastal region than in the mountainous region, though the differences were not high (statistically not tested). Interestingly, the percentage of respondents who believed that their vulnerability is reducing over time was higher in the mountainous region (13.6%) than in the coastal region (1.9%). This vulnerability is cumulative of both the primary and secondary disasters in both the regions. However, the percentage of respondents who did not perceive any change in their vulnerability was higher in the coastal region (18.5%) than in the mountainous region (11.6%). It is discernable that vulnerabilities are increasing over years despite developmental initiatives. Alternatively, it can also be inferred that developmental initiatives have failed to instill confidence among communities.

The gender-disaggregated analysis of changes in vulnerability

“The humans and animals use the same water source in this stream. The polluted water is the source of health problems.”

Cato Sinh, Da Ba Cai hamlet

didn't reveal much difference in the opinion among respondents. However, more female respondents in the mountainous region believed that their vulnerability is reducing over time than was felt by their counterparts in the coastal region.

Table 18: Is your vulnerability changing over the years?

S No		Coastal Region		Mountainous Region	
		Males	Female	Male	Female
1	Increasing	79.5	79.2	81.8	61.4
2	Decreasing	3.3	0.0	12.1	17.0
3	No change	17.2	20.8	6.1	21.6

The discussions and questionnaire surveys did not reveal much information on what communities think about why their vulnerabilities are increasing. To this end, on an average across study locations, 83.6% of respondents could not identify reasons why their vulnerabilities to natural disasters are increasing. However, more respondents in the coastal region could identify the reason (cutting of forests, 19.5%) than in the mountainous region (due to changing weather, 3.9%). When asked if changes they observed were due to climate change, only 12.7% agreed while 83% could not comment on it.



“We don’t want to go to forest to cut trees but we have no choice. We have to go there for our food.”

Chamale Anh, Ma Ro hamlet

Figure 16: Illegal cutting of forests is a main cause for concern

5.1.4. Disaster management

Communities were also asked about what they believe about disaster management systems in vogue in their location. Questions were focused more on the early warning and preparedness mechanisms as they enable communities to be prepared and help in reducing the impact of recurring disasters.

Limitations in the Current Drought Management

The following limitations were identified by the National Forum conducted in Hanoi

1.1.1. Policy and regulation related limitations

- Lack of sufficient importance given to drought risk management including preparedness programs by the government institutions
- Lack of drought management board at provincial, district and commune levels
- There is no policy for agriculture assistance
- Lack of long term programs for drought preparedness
- Poor participation of appropriate authorities in decision making and development planning
- There is a conflict between various social and economic sectoral organizations that is hindering the development and implementation of drought risk management initiatives
- The overlap of administrative management in sharing authority and decision making
- Lack of appropriate regulation on water exploitation
- Poor management of irrigation projects
- Poor participation of communities in long term drought mitigation programs

1.1.2. Knowledge, technology and human resources

- Lack of knowledge on drought preparedness
- Lack of information on appropriate agricultural practices
- Lack of human resource especially the technical staff who can guide farmers on better management practices
- Lack of reliable drought forecasting mechanism
- The perception of communities and some governmental institutes on climate change, drought and environment is a limitation in taking up appropriate drought mitigation activities
- Lack of drought resistant crop varieties and animal breeds

1.1.3. Financial limitations

- Lack of sufficient financial support during drought times
- Deficit finance on irrigation projects
- No budget for drought preparedness at province and below levels

Early warning systems

Drought is known to provide several natural indicators before and during its occurrence. Globally, there has been much emphasis on identifying such traditional early warning systems. Indicators

used in traditional early warning systems include animal behaviour, vegetation characteristics, nutritional characteristics and weather and climate behaviours. However, the survey could not identify existence of traditional early warning mechanisms such as changes in animal behaviours as they seem to have been overshadowed by the modern approaches such as obtaining weather information from community leaders and from other communication channels such as radio and television. More communities obtained the early warning information from their community leaders in the mountainous region (55.2 %) than in the coastal region (0%) reflecting the active community leadership in disaster risk management. Coastal communities obtained the early warning through modern communication media such as radio, television etc (86.5% of respondents). Contrarily, only 16% of respondents in the mountainous region obtained early warning from radio and television. This could be inferred as an indication of developmental differences between these two regions. When asked specifically about from whom they obtain early warning within the government, majority of respondents, irrespective of the region, said that they obtained the early warning from local community leaders (78.2%). The early warning was better developed for the flood forecasting than for drought.



Figure 17: Early warning systems are well developed for the flood warning but not for the drought warning

Most of respondents felt that the existing early warning systems are sufficient for them to identify the impending disaster such as floods (52.9%). This number is much higher in the coastal region (67.8%) than in the mountainous region (37.9%). Such differences could be potentially attributed to the medium through which the early warning is received (community leaders in mountainous region vs. television and radio in coastal region) and the type of information they received (the survey didn't look into the contents of the early warning provided to communities). 77.6% of respondents believed that the early warning was timely. Improving the radio broadcasting system emerged as a major suggestion from communities at all study locations in the coastal region (64%). In Hoa Thanh-Nam Cuong, communities wanted training on understanding the early warning and dissemination (11.5%) and provision of weather information direct to communities so that it can be readily disseminated within the community (3.8%).

When asked about the time taken for their areas to be declared disaster affected, 55.8% of respondents in the coastal region said they usually received the declaration in the second week after the occurrence of disaster. The time taken to declare the areas affected by the disaster is much higher in the mountainous region. Communities in the mountainous region believed that

they are declared as disaster affected only after three weeks of the disaster incidence (36.4%). When asked about the role of communities in the disaster declaration, 38% of respondents believed they had no role. This percentage was higher in the coastal region (52.7) than in the mountainous region (23.3). However, community members had a role in reporting the disaster impacts to community leaders at both study locations, 44.6% of respondents reported. The communication of disaster information to neighbours was higher in the mountainous region (30.1%) than in the coastal region (4.7%). This corroborates earlier results on information sources at both locations. Communities said they had a role in reporting the damage (40.1%) and damage assessment (15.4%) while 44.5% of respondents felt they were not involved in disaster damage assessment or disaster declaration. More communities were involved in reporting the damage in the mountainous region (57.2%) than in the coastal region (23.1%).

Disaster response

The objective of providing early warning is to help enhance the preparedness such that the response after the disaster is much faster and the impacts are reduced to minimal. Irrespective of the study location, respondents believed that communities are first to respond to disasters (85.4%). All respondents in the coastal region reported communities as the first respondents. Relatively, NGOs (20% in Da Ba Cai) and local governments (18.5% in Ma Ro) were also reported to be first respondents to disasters in the mountainous region. Food preservation (storage) appears to be the major adaptation mechanism of communities (32.7% of respondents) followed by preservation of seeds for the next cropping season (24.6% of respondents). Communities in the coastal region gave more preference to saving water (21.3% of respondents) than in the mountainous region (13.3% respondents) due to more relative scarcity in the former place.



“We built 5 big cement tanks for filling drinking water from the streams but the streams have dried up so there is no water to fill the tanks.”

*Chamale Tien,
Chairman of Phuoc
Thanh people’s
committee*

Figure 18: Water storage jars supplied by UNICEF in Phuoc Thanh commune

The response of NGOs to droughts includes provision of water storage facilities such as temporary storage tanks and water jars (23.5% respondents in coastal region and 18.5% in mountainous region) (Figure 18); supply of food grains (20.2% in coastal region and 5.6% in mountainous region) and imparting training in disaster management (only in coastal region). Provision of food grains, building community wells, and establishing community volunteer teams to supply water constitute the primary response of local and provincial governments (Table 19) while the central government is known to provide food and financial assistance.

The adequacy of responses by communities, NGOs and governments was found to be different at different locations. Communities in the coastal region were more happy with the response by various stakeholders (59.2% said adequate) than in the mountainous region (only 4% said that the response was adequate). Lack of knowledge in dealing with drought situations and lack of enough means of storing water were identified as major limitations in drought risk management across study locations, despite the efforts made by various stakeholders at all study locations.

Table 19: Responses of local, provincial and central governments to drought (% of responses)

Responses	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Communities				
1. Saving water	35.0	7.7	0.0	0.0
2. Preserve food	13.3	38.5	44.0	0.0
3. Preserve seeds	0.0	11.5	56.0	0.0
4. All above	51.7	42.3		100.0
NGOs				
1. Water storage facilities (tanks, ring wells and jars)	31.7	15.4	0.0	37.0
2. Food assistance	25.0	15.4	0.0	11.1
3. Disaster Training	-*	7.7	-	-
4. All above	23.3	53.8	100.0	51.9
0. Do not know	20.0	7.7	-	
Local Government				
1. Provide seeds	0.0	7.7	0.0	0.0
2. Building commune wells	0.0	19.2	0.0	0.0
3. Establish the volunteer team to provide free water	-	30.8	-	-
3. All above	100.0	42.3	100.0	100.0
Provincial government				
1. Food assistance	0.0	0.0	0	0.0
2. Irrigation facilities	0.0	0.0	100	0.0
3. All Above	100.0	100.0	-	100.0
Central government				
1. Food assistance	0.0	46.2	0	100.0
2. Loan	0.0	42.3	0	-
3. All above	100.0	0.0	100	-
4.. Do not know	-	11.5	-	-

* indicates no data from these open ended questions due to no identification of them as a choice.

Communities were aware about the existing long-term drought mitigation programs being implemented by NGOs and local governments (85.6% said they know). However, the majority of respondents believed that they had no role in these programs (89.3%) while others identified roles such as participation in the local risk identification process (e.g. risk mapping), identification of possible drought mitigation programs etc. However, number of people who participated in such programs and processes was low as only 10.7% of respondents said they participated in these programs. Some of the drought mitigation programs in vogue are given in Table 20.

Table 20: Drought mitigation programs being implemented at study locations by NGOs and governments

	Organizations	Mountainous areas	Costal areas
1	Central Government	<ul style="list-style-type: none"> - Program Number 135 (*) - Program Number 134 (*) - Reforestation program (*) - Constructing irrigation systems (*) - Food assistance 	<ul style="list-style-type: none"> - Reforestation program (*) - Constructing irrigation systems (*) - Food assistance
2	Provincial Government	<ul style="list-style-type: none"> - Development of new drought resistant varieties (*) by the centre at Nha Ho - Constructing irrigation systems (*) - Digging wells - Provided the low price of new seeds for farmers 	<ul style="list-style-type: none"> - Development of new drought resistant varieties (*) by Nha Ho centre - Constructing irrigation systems. (*) - Digging wells - Subsidies for new varieties
3	Local Government	<ul style="list-style-type: none"> - Digging wells 	<ul style="list-style-type: none"> - Digging wells
4	Oxfam GB	<ul style="list-style-type: none"> - Improving food and income security for poor women and men in Bac Ai district (*) - Poverty reduction project in 2 communes in Bac Ai district (*) - Food and water storage facilities and public health camps for communities in Bac Ai district - Construction of wells and small water reservoirs - Establishing pump service team in all villages of 2 communes in Bac Ai district - Drought response fund for 2 communes in Bac Ai district 	<ul style="list-style-type: none"> - Food and water storage facilities and public health camps for communities in Ninh Phuoc district
5	UNICEF	<ul style="list-style-type: none"> - Water supply for ethnic groups (*) 	<ul style="list-style-type: none"> - Installation of pump wells
6	Action Aid		<ul style="list-style-type: none"> - Community based model for disaster mitigation and management in Ninh Phuoc district. (*) (Training and relief assistance)
7	Red Cross	<ul style="list-style-type: none"> - Provision of food and water storage facilities 	<ul style="list-style-type: none"> - Provision of food and water storage facilities
8	World Vision	<ul style="list-style-type: none"> - Provision of food and water storage facilities in Bac Ai district 	
9	Counterpart International	<ul style="list-style-type: none"> - Food assistance for 5 districts of Ninh Thuan province 	

* Long term programs



“The animal husbandry in Ninh Phuoc district has been coping with many problems. There is no enough fodder and drinking water for animals in the dry season. The price of fodder is increasing and the price of animals is decreasing.”

*Ba Nien Huong,
veterinary doctor of Ninh
Phuoc district.*

Figure 19: Indigenous cattle breed needs to be replaced with the improved ones for better income security and drought resistance

5.1.5. Climate change

Impacts

An attempt was made to identify if communities understand and differentiate the short-term weather phenomenon and long-term climate change phenomenon. To our surprise, all respondents said they know differences between weather and climatic processes. However, none could explain the difference. In addition, it was not so easy to obtain information on how communities use weather and climate information in crop planning. Farmers here mostly rely upon the crop calendar decided by the agricultural department of the provincial government which provides information on when to sow the seed and when to take up management practices. Respondents said that the reliance on this mechanism made them to think independent of weather and climatic information available outside the crop calendar.

Awareness about climate change is an important aspect to initiate desirable actions by stakeholders. Communities differed in their awareness about climate change in coastal and mountainous regions. Majority of respondents in the coastal region were aware that the climate is changing (88.7% of respondents) while none in the mountainous region could state that the climate is changing.

Communities were asked to identify specific changes they have observed in the climate. The responses were presented in Table 21. Communities could identify increasing temperatures, declining rainfall, biodiversity (number, density and composition) and increasing disasters. It is possible to conclude from the results that, though communities in mountainous region could not ‘state’ that the ‘climate is changing,’ they could very well identify the changes in various parameters of climate such as those listed in Table 21. This brings us to the fact that the term ‘climate change’ may well not be in vogue among communities but they could always identify impacts of it. However, majority of respondents

“I do not know about the climate change, I just feel the change of weather. It is getting hotter day by day.”

*Chamale Hung, Villager
of Da Ba Cai hamlet*

could not identify reasons for these changes (73.7% in coastal region and 100% in mountainous region). It is relevant here to cross check these findings with the actual data presented in Figure 12 which shows increasing trends in the rainfall. The difference between observed and perceived trends could be attributed to the lack of long-term memory among communities and putting more emphasis on short-term changes in the climate such as inter-annual variability of rainfall and temperature.

Table 21: Climate change trends observed by communities (% of responses)

Impacts	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
1. Temperature (Increasing)	83.3	73.0	80.0	92.3
2. Rainfall (declining)	76.7	73.1	80.0	65.4
3. Biodiversity Composition (Declining)	53.3	50.0	60.0	57.7
4. Biodiversity Number/density (Declining)	50.0	48.0	52.0	80.8
5. Disaster (magnitude, duration and intensity)	80.0	52.0	76.0	88.5

The gender disaggregated analysis of responses on impacts of climate change revealed more or less agreement between genders. While both males and females could identify, broadly, that the rainfall and biodiversity were decreasing and temperatures and disasters were increasing, they differed to a certain extent in their agreement on the finer details of trends they reported. The differences were much higher in Da Ba Cai where female respondents observed no change in the biodiversity while males reported a moderate decrease in number and composition of the biodiversity (Table 22).

Table 22: Gender disaggregated responses on awareness of climate change impacts

Impacts	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Males				
Temperatures	Moderately increasing	Steeply increasing	Steeply increasing	Steeply increasing
Rainfall	Decreasing steeply	Moderately decreasing	Moderately decreasing	Moderately decreasing
Biodiversity composition	Decreasing steeply	Moderately decreasing	Moderately decreasing	Moderately decreasing
Biodiversity number	No change	Moderately decreasing	Moderately decreasing	Moderately decreasing
Disasters	Increasing steeply	Steeply increasing	Moderately increasing	Steeply increasing
Females				
Temperatures	Moderately increasing	Steeply increasing	Steeply increasing	Steeply increasing
Rainfall	Decreasing steeply	Steeply decreasing	Steeply decreasing	Moderately decreasing
Biodiversity composition	Decreasing steeply	Moderately increasing	No change	Moderately decreasing
Biodiversity number	Decreasing steeply	No change	No change	Moderately decreasing
Disasters	Increasing steeply	No change/Steeply increasing	Moderately or steeply increasing	Steeply increasing

Adaptation strategies

Both autonomous and planned adaptation strategies were discussed with communities and results are presented here.

Autonomous adaptation strategies

The summary of findings is provided in Table 23. Communities could identify autonomous adaptation strategies in agriculture, animal husbandry, water resources, food and economic safety that are in vogue. Growing new crop varieties and formulation of seasonal calendar were major autonomous adaptation strategies to deal with drought impacts on agriculture. In animal husbandry, change of animal breeds and finding new feed and fodder sources were the most important practices in the mountainous region while growing fodder crops became an important strategy in the coastal region. Communities in the coastal region followed a wider number of animal husbandry strategies than in the mountainous region which could be a reflection of their developmental level.

Table 23: Autonomous adaptation strategies identified by communities (% of responses)

Strategy	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Agriculture				
1. Saving seeds	5.0	11.5	60	3.8
2. Change the crop plan	16.7	46.2	40	0.0
3. Change seeds (drought resistant, short day crops)	6.7	26.9	.*	69.2
4. Change seeds and crop plan	55.0	15.4	-	26.9
5. All above	16.7	0.0	-	-
Animal Husbandry				
1. Change breeds	0.0	11.5	32	19.2
2. Looking for new feed resource	0.0	7.7	68	38.5
3. Grow grass	42.0	26.9	-	-
4. To vaccinate animals	0.0	7.7	-	-
5. All above	58.0	3.8	-	42.3
6. No action		42.3		
Water resources				
1. Digging wells	21.7	50.0	32	30.8
2. Reuse of water	15.0	19.2	44	30.8
3. Economizing the water use	55.0	26.9	24.0	15.4
4. All above	8.3	3.8	-	23.1
Food safety				
1. Save food	95.0	69.2	-	61.5
2. Do nothing	5.0	30.8	100	38.5
Economic safety (by improved income)				
1. Looking for new jobs	21.7	26.9	-	-
2. Move to big cities for job	26.7	15.4	-	-
3. Saving money		3.8		
4. Do nothing	51.7	53.8	100	100.0

* indicates no data from these open ended questions as respondents couldn't identify any adaptation practice in vogue.

Planned adaptation strategies

Information on planned adaptation strategies is presented in Table 24. The major planned adaptation option in agriculture is to extend irrigation facilities through establishing deep wells and open wells. Provision of latest varieties at low prices has also been taken up by governments and NGOs. Vaccines for animals were provided in Long Binh during drought. Other major adaptation measures found in the water sector were digging of wells by both NGOs and governments and provision of water storage facilities such as portable tanks and jars by NGOs. Supply of food grains and provision of loans during stress times were other adaptation measures taken up by the NGOs and governments. Respondents felt that these measures could help them in reducing the drought impacts partly (59%). Male and female respondents from the mountainous region have less migration opportunities due to the limited education, knowledge and skills that may be of use elsewhere. Majority of mountainous people are from the ethnic minority and are deprived of education facilities. They prefer to live without much external intervention, one of respondents observed.

Table 24: Planned adaptation actions identified at study locations (% of responses)

Parameter	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Agriculture				
1. To build irrigation system (NGO & GOV)	0.0	76.9	20	30.8
2. Provide seeds (low price) (GOV)	0.0	15.4	24	69.2
3. All above	100.0	7.7	56	-*
Animal Husbandry				
1. Vaccine (GOV)	100.0	34.6	-	42.3
2. Do nothing	0.0	65.4	100	57.7
Water resources				
1. Provide tools to collect and save water (NGO)	0.0	23.1	100	100.0
2. Digging pump wells (NGO & GOV)	0.0	15.4	-	-
3. Chemicals to treat polluted water	0.0	15.4	-	-
4. All above	100.0	7.7	-	-
5. Do not know	-	38.5	-	-
Food storage/safety				
1. Food assistance (NGO & GOV)	66.7	53.8	100	100.0
2. Do not know	33.3	46.2	-	-
Economic safety				
1. Loans (GOV)	65.0	50	100	50.0
2. Do nothing	35.0	50	-	50.0

* indicates no data from these open ended questions due to no identification of them as a choice.

Heavy reliance on groundwater had resulted in decline of groundwater table and saline water ingress in coastal areas. Communities believed that better financial support by governments and better access to markets are needed to reduce their vulnerabilities. While better education, facilities for income diversification and improving livelihoods were prioritized by the coastal communities, communities from the mountainous region have identified income diversification and provision of better financial facilities as most important strategies to reduce their vulnerability. At both locations, respondents felt that very few livelihood options are available to them. Communities have equally rated government and NGOs in reducing community's vulnerabilities.



“Most of the villagers are trying to dig new wells but the wells are becoming saline since 2003.”

Vo Xuan Thanh, Hoa Thanh hamlet

Figure 20: Digging wells has been a prominent drought adaptation option by many intervening agencies while ignoring the groundwater recharge on the other hand

Gender disaggregated responses showed that communities prefer financial support rather than other options for reducing their vulnerability to climatic events. However, more of the female respondents in Da Ba Cai and Ma Ro believed in income diversification than in direct financial support. This can be understood from the fact that both locations are in the mountainous region where income generation opportunities are poorly developed.

Table 25: Gender disaggregated responses on activities to reduce the vulnerability to climatic events (top ranked options by respondents)

Impacts	Coastal Region		Mountainous Region	
	Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Males	Better financial support	Better financial support	Better financial support	Better financial support
Females	Better financial support	Better financial support	Income diversification	Income diversification

5.2. Government Officials and Mass Organizations

This section provides a brief on interaction with government and non-governmental officials at village, commune, and district levels. The aim was to assess their perceptions on climate change and disaster management interventions being taken up.

Officers, without exception of level at which they operate (i.e. village, commune and provincial levels both in coastal and mountainous regions), were well aware that the climate has been changing. However, they were not aware about how to translate the state of being aware about climate change into tangible actions in their respective departments because of lack of information on what kind of interventions could be implemented to reduce the impact of climate change. Officers were asked to rank sectors based on their vulnerability to climate change impacts. Results from the coastal region showed that the agriculture is the most vulnerable to climate change followed by animal husbandry, aquaculture and forestry (Table 26).

Table 26: Vulnerability ranking of various sectors to climate change

Coastal Region		Mountainous region	
Rank	Sector	Rank	Sector
1	Agriculture	1	Agriculture
2	Animal husbandry	2	Animal husbandry
3	Aquaculture	3	Forestry
4	Forestry		

Some indicators of change in disaster profile are given below:

- Change from floods and storms to more drought conditions.
- Increasing temperatures.
- Decrease in the number and intensity of storms.

The change in disaster behavior (in intensity, duration and periodicity of occurrence) was attributed to the climate change. All officers were aware that communities, governments and NGOs can adapt to the changing climate. The following adaptation options were identified during focus group discussions.

1. Preparation of hazard, vulnerability and risk maps
2. Imparting training to farming communities on various best management practices that reduce the water consumption while obtaining higher productivity
3. Introduction of high yielding, short duration and high temperature resistant cultivars
4. Establishing small scale irrigation schemes
5. Provision of micro-finance loans for women to initiate small-scale livelihood options such as petty-shops, purchasing livestock, growing crops etc
6. Imparting training on raising new shrimp breeds that could withstand higher temperatures and resist diseases

The following issues emerged during the group discussion conducted with government officials where they were introduced to the findings of the study.

One of the root causes of vulnerability of communities to climatic events is related to the poor knowledge as well as lack of capacity to cope with natural disasters. It is more to do with the developmental state of study locations rather than to do with the changing rainfall situation. Inadequate food availability and consumption are common problems with ethnic communities in the mountainous region since time immemorial, which was due to harsh environmental conditions and lack of knowledge on better management practices.

Drought (lack of water and saline water intrusion into fresh water areas) is believed to be partly due to methods of cultivation. For example, there has been tremendous growth in the area under wet paddy, due to conversion from the dry paddy, which has considerably increased the demand for water. Introduction of high-yielding varieties has only increased the burden on limited water resources. Part of the increasing water demand was also due to increase in population. In addition, issues such as heavy reliance on ground water resources, deforestation and shifting

“We do not have enough fresh water for our basic needs since 2004. Almost all the pump wells in this village are affected by the saline water intrusion.”

Mr. Diem, Long Binh village leader

cultivation have worsened the situation. Another reason is increasing area under shrimp cultivation. There has been a tremendous boost in shrimp cultivation during recent years. Figure 11 supports this fact. The area decreased in 2005 due to declining fresh water availability, diseases and water pollution. For example, in the past 40 years, the per capita water availability per person per year was about 17,000 m³. In 2005, that amount has reduced to 4,600 m³. The root cause is the ‘water war’ between sectors such as agriculture, aquaculture, industry, and tourism. There is a need to share the limited water among all sectors with appropriate prioritization to the priority sectors such as agriculture which provides livelihoods to more people than any other livelihood option. The part of health problems during drought as well as normal times is due to the prevalence of unhygienic conditions caused by raising the animals near house and water source and using the same water source for both animal and human consumption.

5.2.1. Short-term programs

The following short-term options emerged during discussions with officers.

- Food assistance, fresh water supply in drought season for both areas – mountainous region and coastal region (by NGOs, Government and others)

5.2.2. Long-term programs

The following long-term options emerged during discussions with officers.

Programs	mountainous region	coastal region
Enhancing the perception of communities on environmental and natural resource issues	x	x
Develop drought resistant crop seeds	x	x
Enhancing the irrigation efficiency	x	x
Establish/find the markets for animal products, grapes, cashew etc	x	x
Reduce the area under paddy cultivation and change land-use practices		x
Create new livelihoods that rely less on water (e.g. handicrafts, small-scale industries)	x	x
Establish individual water supply companies to provide water for rural areas	x	x
Forest conservation by appropriate laws and reforestation on bald hills to enable groundwater recharging	x	x
Reduce the area under shrimp farming and improve the drainage canal		x

The water war between different sectors could be reduced by assessing water needs and water supply for each sector; controlling the water usage through taxes and subsidies as incentives; and increasing the water use efficiency.

6. Policy Options

Policy options for planning drought risk mitigation and reducing the vulnerability to climate variability and change are identified in this section. Many of the policy options identified in this section corroborate with suggestions from officials presented in the previous section.

6.1.Impacts

Impacts of recurring droughts and their root causes were identified through focused group discussions. Initially, participants were asked to identify various impacts of droughts in their locality. These impacts were subsequently ranked according to the relative importance placed by communities on each of them. Identified impacts were grouped into economic, social and environmental categories and presented in Table 27.

Table 27: Ranked impacts of recurring droughts in Ninh Thuan province

Category	Sub category	Coastal Region		Mountainous Region	
		Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
Economic	Agriculture	<ul style="list-style-type: none"> • Damage to crops • Unavailability of water for irrigation • Income loss 	<ul style="list-style-type: none"> • Damage to crops • Income loss 	<ul style="list-style-type: none"> • Death of maize, rice and cassava crops • Drying and shedding of cashew nut fruits • Income loss 	<ul style="list-style-type: none"> • Death of maize and cassava crops • Drying and shedding of cashew nut fruits. • Income loss
	Animal husbandry	<ul style="list-style-type: none"> • Reduced productivity of cattle • Unavailability of feed and fodder • Unavailability of water 	<ul style="list-style-type: none"> • Lack of fodder • Lack of water 	<ul style="list-style-type: none"> • Lack of fodder • Lack of water • Diseases, under nutrition and starvation 	<ul style="list-style-type: none"> • Lack of fodder • Lack of water • Diseases, under nutrition and starvation
	Water resources	<ul style="list-style-type: none"> • Lack of water • High cost of water 	<ul style="list-style-type: none"> • Lack of water • High cost of water 	<ul style="list-style-type: none"> • Disruption of water supplies for various activities • Lack of water 	<ul style="list-style-type: none"> • Disruption of water supplies for various activities • Lack of water
Social	Health and nutrition	<ul style="list-style-type: none"> • Health related problems (Diarrhea and cold) • Food shortage 	<ul style="list-style-type: none"> • Health related problems • Food shortage 	<ul style="list-style-type: none"> • Health related problems (Malaria, diarrhea, heat stroke) • Food shortage 	<ul style="list-style-type: none"> • Health related problems (Malaria, diarrhea, heat stroke) • Food shortage
	Gender	<ul style="list-style-type: none"> • Both genders spend considerable time in getting water from long distances 	<ul style="list-style-type: none"> • Both genders spend considerable time in getting water from long distances 	<ul style="list-style-type: none"> • More stress on women in carrying water • Less per-capita consumption of water by females 	<ul style="list-style-type: none"> • More stress on women in carrying water • Women suffer more nutritional problems
	Others	<ul style="list-style-type: none"> • School dropout 	<ul style="list-style-type: none"> • Short duration 	<ul style="list-style-type: none"> • Shifting into 	

Category	Sub category	Coastal Region		Mountainous Region	
		Long Binh	Hoa Thanh-Nam Cuong	Da Ba Cai	Ma Ro
		<ul style="list-style-type: none"> • Migration to other provinces and cities for work • Old people are left unattended due to excessive migration of young 	migration <ul style="list-style-type: none"> • Migration to other provinces and cities for work 	small dwellings	
Environmental		Loss of biodiversity	<ul style="list-style-type: none"> • Saline water intrusion • Over exploitation of groundwater • Loss of biodiversity 	Loss of biodiversity	<ul style="list-style-type: none"> • Cutting down of forests for fetching firewood as an economic activity • Loss of biodiversity

6.2.Root Causes

In this section, root causes (underlying causes) are identified. Impact tree diagrams were constructed for ranked impacts and root causes were arrived by asking probing questions such as ‘why lack of water’. Some examples are given in Figures 23 and 24. Root causes are presented in Table 28. In some instances, more than one root cause was identified for each impact. Similarly, the same root cause can be traced to multiple impacts. Root causes for different hamlets within coastal and mountainous region were merged as root causes were identical within the region.

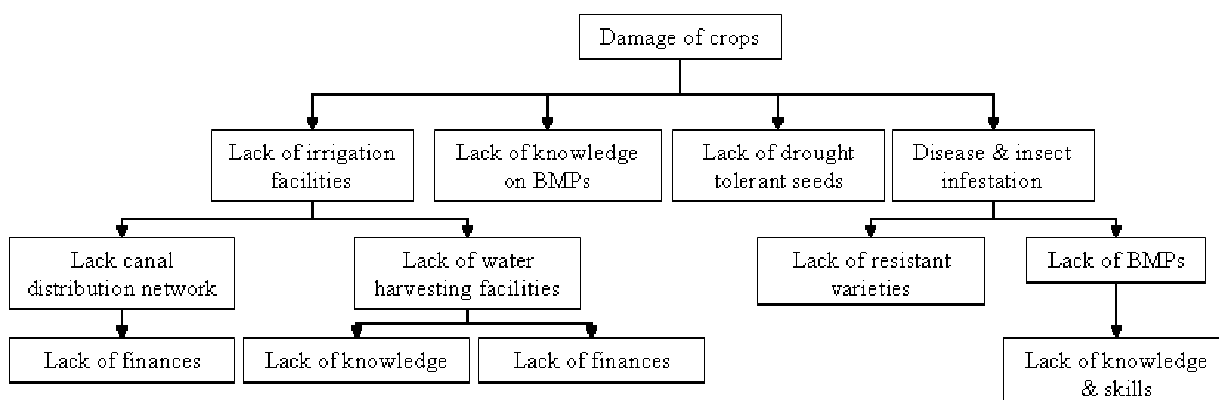


Figure 21: An example impact tree diagram for agriculture

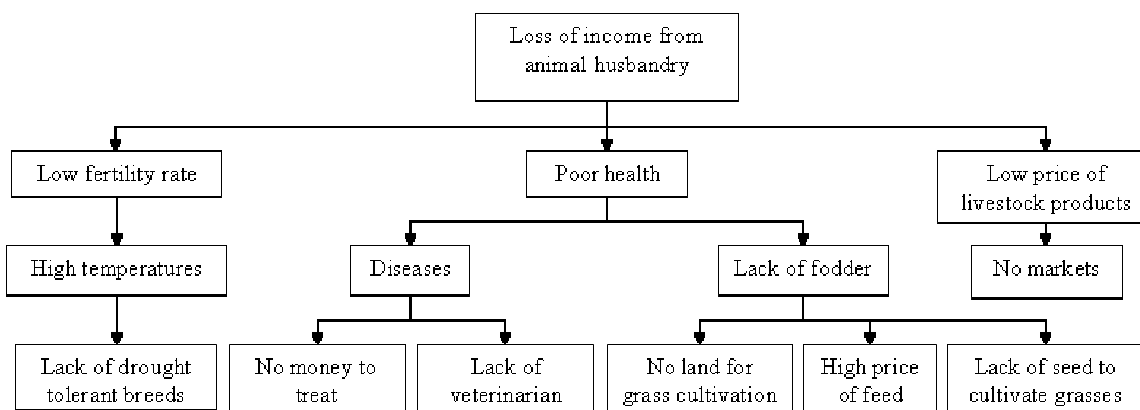


Figure 22: An example impact tree diagram for animal husbandry

Table 28: Root causes identified for the most important ranked impacts

Category	Drought Impact	Important root causes	
		Coastal Region (Long Binh & Hoa Thanh-Nam Cuong)	Mountainous Region (Da Ba Cai & Ma Ro)
Economic	Damage of crops	<ul style="list-style-type: none"> • Lack of financial capital • Rainfall variability • Lack of timely weather forecasting and agromet advisory 	<ul style="list-style-type: none"> • Lack of drought tolerant maize and cassava varieties • Rainfall variability • Lack of timely weather forecasting and agromet advisory • Lack of knowledge on best management practices
	Unavailability of irrigation and drinking water	<ul style="list-style-type: none"> • Lack of regulations to stop unlawful withholding of water at the upper reaches of the canal • Decline in the water table • Decline in storage capacity of reservoirs and dams • Lack of sufficient electricity • Lack of rain water harvesting practices 	<ul style="list-style-type: none"> • Lack of canal distribution network for the existing water storage facilities • Lack of rains • Lack of financial capital
	Income loss	<ul style="list-style-type: none"> • Lack of alternative livelihood activities and sole dependence on agriculture 	<ul style="list-style-type: none"> • No access to good market facilities and hence less power to bargain good price of animals reared.
	Loss of productivity of cattle and degradation of health	<ul style="list-style-type: none"> • Lack of financial capital • Lack of knowledge on better rearing practices • Lack of drought tolerant breeds • Lack of veterinary health facilities • Lack of better fodder varieties • High fodder prices 	<ul style="list-style-type: none"> • Lack of financial capital • Lack of knowledge on better rearing practices • Cannot diversify to poultry due to avian flue • Cannot diversify to piggery due to lack of productive stock • Lack of veterinary health facilities • Lack of better fodder varieties

Category	Drought Impact	Important root causes	
		Coastal Region (Long Binh & Hoa Thanh-Nam Cuong)	Mountainous Region (Da Ba Cai & Ma Ro)
	Lack of fodder	<ul style="list-style-type: none"> • Lack of common grazing land • Insufficient or no fodder supply during relief 	<ul style="list-style-type: none"> • Lack of common grazing land • Insufficient or no fodder supply during relief
	Loss of employment	<ul style="list-style-type: none"> • Availability of more labor force within the hamlet • Lack of sufficient work opportunity within the hamlet 	<ul style="list-style-type: none"> • Insufficient economic activity within the hamlet • Lack diversified skills (dependence on primitive livelihood activities)
Social	Health, nutritional, and physical problems	<ul style="list-style-type: none"> • Social structure (less power in decision making) • Expectation of doing less burdensome works 	<ul style="list-style-type: none"> • Inability to speak Vietnamese hindering women to participate in economic activities
	Food shortage	<ul style="list-style-type: none"> • No abundant relief supply 	<ul style="list-style-type: none"> • No abundant relief supply
	Migration	<ul style="list-style-type: none"> • Lack of jobs locally 	<ul style="list-style-type: none"> • Lack of jobs locally
	Stress on old people	<ul style="list-style-type: none"> • Migration of young 	<ul style="list-style-type: none"> • Migration of young
Environmental	Cutting of forests	<ul style="list-style-type: none"> • Lack of employment facilities 	<ul style="list-style-type: none"> • Lack of alternative employment facilities
	Loss of biodiversity	<ul style="list-style-type: none"> • Recurring droughts and heat stress 	<ul style="list-style-type: none"> • Recurring droughts and heat stress
	Saline water intrusion	<ul style="list-style-type: none"> • Excessive withdrawal of groundwater 	-
	Over-exploitation of groundwater	<ul style="list-style-type: none"> • Lack of regulatory policies 	

6.3. Policy Options to Reduce Drought Vulnerability

Based on above root causes, policy options were identified for drought risk reduction (Table 30). These could be implemented by governments, NGOs and communities. Emphasis has been given to identify a mix of policy options containing mitigation and response strategies.

A national forum was organized on adaptation to drought in the context of climate change on 3-4 May 2007 at Hanoi, Vietnam. Officers of provincial, district and commune levels from 8 provinces that are affected by the drought have participated in the forum. The forum has focused on impacts of drought at the commune level and identified difficulties and existing gaps in coping with the drought. The forum had also come out with appropriate suggestions to overcome the community vulnerability to drought. The suggestions are listed below.

Communities

- Strengthen community organization by establishing or building upon social institutions like village Self-Help Groups (SHGs), women groups and village water sub-committees
- Set up a commune seed bank / food credit coupon system
- Establish 'Village emergency fund'
- Develop understanding that the drought may be a recurring phenomenon and they should prepare themselves to minimize the impact
- Better forest management and avoiding forest fires

Table 29: Drought risk reduction action identification matrix

Impact of drought	Root causes	Possible actions	Mitigation (M), response (R)
Damage of crops	<ul style="list-style-type: none"> • Lack of financial capital 	<ul style="list-style-type: none"> • Provision of more micro-finance options 	M
	<ul style="list-style-type: none"> • Rainfall variability 	<ul style="list-style-type: none"> • Enhanced weather monitoring and forecasting 	M
	<ul style="list-style-type: none"> • Lack of timely weather forecasting and agro-met advisory 	<ul style="list-style-type: none"> • Improving agro-met advisory services 	M
Unavailability of irrigation and drinking water	<ul style="list-style-type: none"> • Lack of regulations to stop unlawful withholding of water at the upper reaches of the canal • ‘Water war’ due to increased demand by different sections of the society 	<ul style="list-style-type: none"> • Regulations to restrict water usage through strict command level irrigation scheduling and water distribution • Educating farmers on best management practices • Provide better access to water by establishing water allocation systems 	M
	<ul style="list-style-type: none"> • Decline in the water table 	<ul style="list-style-type: none"> • Educate on better irrigation practices to enhance irrigation efficiency 	M
	<ul style="list-style-type: none"> • Decline in storage capacity of reservoirs and dams 	<ul style="list-style-type: none"> • Control of siltation through land stabilization in watersheds • Soil conservation practices in watersheds 	M
	<ul style="list-style-type: none"> • Lack of sufficient electricity to pump water 	<ul style="list-style-type: none"> • Supply of solar-power systems using cooperative societies 	M
	<ul style="list-style-type: none"> • Lack of rain water harvesting practices 	<ul style="list-style-type: none"> • Educate and introduce watershed management practices 	M
Income loss	<ul style="list-style-type: none"> • Lack of alternative livelihood activities and sole dependence on agriculture 	<ul style="list-style-type: none"> • Creating self-help groups and micro-credit systems • Introduction of non-agriculture based livelihood practices • Provision of training on alternative livelihood practices 	M
Loss of productivity of cattle and degradation of health	<ul style="list-style-type: none"> • Lack of financial capital 	<ul style="list-style-type: none"> • Provision of improved cattle breeds on subsidy • Establishing cattle health camps • Imparting better know how on maintaining cattle herds during drought times 	M
	<ul style="list-style-type: none"> • Lack of knowledge on better rearing practices 	<ul style="list-style-type: none"> • Training on improved animal rearing practices 	M
Lack of fodder	<ul style="list-style-type: none"> • Lack of common grazing land • Lack of fodder storage facilities and know how 	<ul style="list-style-type: none"> • Imparting know how on fodder storage practices • Know how on better feed management practices • Establishment of community based fodder banks 	M
	<ul style="list-style-type: none"> • Insufficient or no fodder supply during relief 	<ul style="list-style-type: none"> • Supply of fodder during relief 	R
Loss of employment	<ul style="list-style-type: none"> • Availability of more labor force within the village • Lack of sufficient jobs within the village 	<ul style="list-style-type: none"> • Skill identification and enhancement through training programs • Providing cooperative market facilities to market the outputs 	M
Health, nutritional, and physical problems to children	<ul style="list-style-type: none"> • Social structure (less power in decision making by women on how the food is distributed in the family) • Expectation [by men] that women do less 	<ul style="list-style-type: none"> • Education and awareness generation programs for all sections of the society • Promoting the culture of collective action • Hygiene promotion 	M

Impact of drought	Root causes	Possible actions	Mitigation (M), response (R)
	burdensome work is leading to reduced food allocation for them • Lack of water and knowledge on hygiene • Lack of nutritious food	• Providing clean drinking water • Additional food to women, pregnant and nursing mothers through public distribution system	
Food shortage	• No abundant relief supply • Lack of purchasing power	• Modification of relief distribution practices based on the review of existing relief management • Establishing local food buffer stocks both by the government and local communities • Promoting non-agricultural livelihood options such as crafts	R
Migration	• Lack of local employment	• Skill identification and enhancement through training programs • Providing cooperative market facilities to market the outputs	M
Increased workload on women	• Women do more household work and field work and it increases during drought times	• Share workload among family members • Make available more water as discussed above • Identify water supply points near dwellings and piped water supply	M
Less participation of women in community programs	• Women (especially ethnic women) don't have security of land tenure • Women in general lack access to formal resources • Women are discriminated against in employment and hence the hindered skill generation • Social role of being restricted to household activities • Lack of social recognition of their work	• Advocacy for changing land tenure and implementing Grassroots Democracy Decree. • Increase women participation and representation through empowerment • Create opportunities for women to work through skill development and providing small credit, technical training, jobs and market information • Social mobilization to change attitudes towards women • Increase community awareness on gender equity	M
Stress on old people	• Migration of young	• Same as above • Establishment of village teams to take care of old people in the migration season	M
Cutting of forests	• Lack of employment facilities	• Same as above	M
Loss of biodiversity	• Recurring drought and heat stress	• Identification of vulnerable species • Encouraging community involvement in maintaining biodiversity	M
Saline water intrusion and Over-exploitation of groundwater	• Excessive withdrawal of groundwater • Lack of regulatory policies	• Introduction of better irrigation management practices • Water pricing and other similar regulatory policies	M

Agriculture

- Developing drought resistant crop varieties
- Provision of know-how on dry season cropping techniques
- Ensuring appropriate crop seeds in place before rains
- Develop village seed bank with seeds of traditional and improved drought resistant crops/varieties
- Impart training on economic water use
- Subsidize/facilitate supply of seeds/irrigation equipment
- Establish farmer field schools and mobile libraries
- Meteorological forecasts and corresponding cultivation advise
- Improved soil moisture management
- Reduce run-off/increase rain water infiltration by planting barriers such as Vetiver, lemon grass, Agave etc
- Increase fertility and water holding capacity of the soil through addition of organic manures and green manures
- Proper land use planning as per the land capability classification
- Promote the mulching practices so that the limited available soil moisture is saved during critical stages of the crop growth

Livelihood strategies

- Support and protect livelihoods, and livelihood diversification (carpentry, petty shops, handicraft, etc.), so that people have a safety net to rely on during all stages of drought
- Establish/strengthen micro credit system

Domestic water use

- Rainwater harvesting (e.g. roof top rainwater harvesting)
- Installing water pumps/wells
- Use of 'home-made', cheap and water-efficient drip irrigation for vegetable garden (for home consumption)

Health

- Providing training in first aid (e.g. treating diarrhea and respiratory diseases)
- Public health promotion, awareness raising on health and hygiene
- Awareness raising on nutrition and home gardening
- Improve access to clean water
- Providing hygiene kits and knowledge to women on use of them

Animal husbandry

- Store rice, paddy husk and other crop residues in barns for use during scarcity
- Grow seasonal grasses/perennial fodder trees in community forest, fallow lands, and permanent pastures
- Recommend farmers to avoid burning of crop residues in the field and use them as animal feed by treating them
- Establish fodder bank at community/household level
- Improve the quality and productivity of the existing livestock population either through artificial insemination or other breeding practices or replacing them with exotic breeds
- Preserve endangered productive & drought resistant local animal breeds
- Promote rearing goat, sheep and dry ducks in areas of feed and water scarcity
- Construct rainwater harvesting structures (mini-ponds, tanks)

Formation of drought management boards

Vietnam is one of the most disaster-prone countries in the Mekong region. Floods and typhoons have been very frequent during the past three decades, and seem to have a greater severity. Floods and typhoons have been a constant threat to the life and productivity of the Vietnamese people. Therefore, the governments have given importance to cope with typhoons and floods by establishing Flood Management Boards at province, district, and commune levels. The national forum has suggested establishing drought management boards at different levels of governments and organizations. The participants have also suggested the roles of different organizations participating in drought management board (Table 30).

It is often difficult to predict the exact onset and cessation of drought, hence making it difficult to initiate response and relief operations in time. Absence of reliable drought forecasting mechanisms makes things even worse. Looking at the success of Boards for dealing with the flood and typhoon risks, Vietnam government should consider establishing special Boards for drought risk mitigation as well. To begin with, the existing boards may be equipped to deal with the drought related contingencies. Slowly, upon obtaining sufficient resources, dedicated Boards could be established which will plan for drought risk mitigation, in addition to drought response and relief. These Boards may be provided with sufficient technically skilled personnel who can keep a watch on local meteorological conditions and develop contingency plans in association with agriculture, water resources, and rural development personnel.

Table 30: The responsibility of different bodies in drought management boards

Body	Responsibility
Central Government	- Provide guidance at the national level
Provincial governments	- Provide guidance at the province level
Ministry of Agriculture and Rural development - Department of Irrigation - Department of Agriculture and Rural development in provincial	- Water supply - Research on strategies for land use planning and water regulation - Cropping patterns - Suggest cropping schedule
Ministry of Health	- Provide health facilities in case of emergency
Ministry of Natural Resource and Environment - Department of Natural Resource and Environment	- Drought forecasting - Drought declaration - Drought assessment - Development planning

Body	Responsibility
Ministry of Labor	<ul style="list-style-type: none"> - Food supply - Implementation of food for work programs
Ministry of Transportation	<ul style="list-style-type: none"> - Help other organizations in case of emergency - Water transportation managements
Ministry of Finance	<ul style="list-style-type: none"> - Provide finances for long-term and short-term programs to cope and mitigate impacts of drought
Other Social organizations (Women's union, farmer associations etc)	<ul style="list-style-type: none"> - Participate in meetings - Provide ideas for better implementation - Promote public participation in programs
Red Cross (International NGOs)	<ul style="list-style-type: none"> - Provide relief - Strategic research - Community needs assessment
Local NGOs	<ul style="list-style-type: none"> - Food assistance - Capacity building - Providing sustainable livelihoods for communities
Scientists and research institutes	<ul style="list-style-type: none"> - Research and training on drought risk mitigation - Developing sustainable livelihood for communities
Communities	<ul style="list-style-type: none"> - Participate in programs - Help various stakeholders understand impacts of drought and in designing better management programs - Coping with impacts of drought
Water supply and Irrigation companies	<ul style="list-style-type: none"> - Water supply - Implement water regulations
Media	<ul style="list-style-type: none"> - Disseminate drought forecasts and better management practices
Ministry of Foreign Affairs	<ul style="list-style-type: none"> - Negotiate on sharing water resource with other countries

7. Future Directions

There is a need to measure the water demand of all sectors in Ninh Thuan province and identify appropriate water sources to, including extending irrigation and water harvesting facilities, to bridge the gap between supply and demand. Sectors to which water should be provided is to be decided thorough consultation with stakeholders and based on the relative importance of each sector in the economic wellbeing of the province. NGOs, government and communities should sit together to find out solutions for drought prone areas.

We recommend that the following activities should be undertaken before acting upon the policy options identified in the previous section.

1. Conduct feasibility studies
 - To narrow down the policy options
 - To increase the success of identified policy options
2. Conduct stakeholder consultations to
 - identify stakeholders and distribute the responsibilities
 - prioritize the policy options based on the resources available with various stakeholders
 - identify the financial, technological and human resources needed for the drought risk reduction activities
 - identify the gaps in the existing capacity within the intervening agencies, and
 - to identify the time-frame for implementation of drought risk reduction activities

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