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# **Effects of Natural Disasters on Agricultural Production Activities in the Cambodia-Laos-Vietnam Development Triangle Area: Case Studies of Ratanakiri (Cambodia), Attapeu (Laos) and Kon Tum (Vietnam) Provinces**

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## **Abstract**

The Cambodia-Laos-Vietnam Development Triangle (CLVDT) area is strategically placed vis-à-vis the economic, social and ecological-environmental aspects of the three countries involved. The agricultural sector has played an important role in contributing to economic growth, ensuring food security, and creating jobs and income for the local people. However, the sector is also one of the worst affected by natural disasters such as floods, flash floods and drought. Since 2001, disasters have occurred in the three provinces of Kon Tum (in Vietnam), Ratanakiri (in Cambodia) and Attapeu (in Laos) every year. While natural disasters have both negative and positive effects on agricultural production-related activities, outcomes are mostly negative. Natural disasters have serious consequences on agricultural production (such as field land, forest land and fishing area), its output, the agricultural infrastructure system, in general, as well as farmer's lives. Various stakeholders are involved in responding to the negative impacts of natural disasters, including central and local governments, the local population, and non-governmental organisations. This paper highlights the significance of indigenous knowledge in adapting to natural disasters in the CLVDT area, as well as the main challenges and recommendations for adapting to and mitigating the negative impacts of natural disasters.

**Keywords:** Agriculture, Cambodia-Laos-Vietnam Development Triangle, climate change, indigenous knowledge, natural disaster.

## **Biography**

Nguyen Tuan Anh is currently a researcher at the Institute for Southeast Asian Studies, Vietnam Academy of Social Sciences. His research interests focus on Vietnam's integration progress in regional and global institutions such as the Cambodia-Laos-Vietnam development triangle area, Greater Mekong Sub-region (GMS) and ASEAN. He has been awarded the 2013-14 ASEAN Canada Junior Fellowship for conducting his research.

## Introduction

The establishment of the Cambodia-Laos-Vietnam Development Triangle (CLVDT) area was a significant development.<sup>1</sup> The area, a vast plateau rich in natural resources, is important for all three countries in terms of environment and national security. CLVDT is home to various ethnicities – there are 31 ethnic groups in Cambodia, 40 in Vietnam and 15 in Laos. Geographically, it connects the entire region with Vietnam's seaports via the economic corridors along various national roads: 78 in Cambodia with 18 in Vietnam; and 16 in Laos linking to national roads 14, 19, 24 and 49 in Vietnam. CLVDT also connects the region with Phnom Penh and Vientiane via national road 7 in Cambodia; and with Hanoi and Ho Chi Minh City via national road 1A and Ho Chi Minh road.<sup>2</sup> The area thus facilitates extensive cooperation and exchange, and promotes socioeconomic development in the three countries.

CLVDT has seen positive economic growth – with annual growth rates higher than the rate set out in the master plan<sup>3</sup> – as the share of the agricultural sector in the area's economy has decreased and that of industry and service increased given large investment projects in hydropower, mining and mineral processing, and high-value industrial processing plants. Over the years, these industrial projects have brought improvements in the region's infrastructure, particularly with respect to transport, postal services and telecommunications, and the electrical grid system, so that people's living standards have improved as well.

Key challenges for CLVDT are to manage its rapid economic growth in the long term and minimise the adverse impacts of environmental degradation and climate change. According to the Intergovernmental Panel on Climate Change (IPCC)<sup>4</sup>, the sustainable development of most developing countries in Asia will be adversely affected by floods and droughts. Primary impact will be in terms of human damage, with extreme weather events resulting in deaths and mental health problems, mainly for the poor<sup>5</sup>. Moreover, natural hazards (such as droughts and floods), which are expected to cause significant reductions in crop yields and agricultural productivity, will lead to food shortages, malnutrition and other diseases. Disasters will also pose

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<sup>1</sup> The initiative was raised by the Royal Cambodian Prime Minister Hun Sen at the first senior meeting of the three prime ministers of Cambodia, Laos and Vietnam in Vientiane in 1999. Then, at the 10th ASEAN Summit in Vientiane in 2004, the leaders of the three countries signed the Vientiane Declaration on the construction of the Cambodia-Laos-Vietnam Development Triangle (CLVDT) area, which comprises of 13 provinces, including Ratanakiri, Stung Treng, Mondul Kiri and Kratie in eastern Cambodia; Attapeu, Salavan,

<sup>2</sup> For more information, see: Cambodia-Laos-Vietnam Development Triangle Portal, 'Development Features and Conditions', [http://clv-development.org/portal/page/portal/clv\\_en/817911/Tab2](http://clv-development.org/portal/page/portal/clv_en/817911/Tab2)

<sup>3</sup> The annual growth rate of the area during the period of 2005–2009 was about 10.2 per cent, which was higher than the target set out in the CLVDT master plan of 2004 (range, 8.4 per cent to 9 per cent). For more information, see: Cambodia-Laos-Vietnam Development Triangle Portal, 'Report on reviewing, adjusting and supplementing the Master Plan for socio-economic development in Cambodia-Laos-Vietnam Development Triangle area up to 2020', November 2010, <http://clv-development.org/portal/pls/portal/docs/4705141.PDF>.

<sup>4</sup> Intergovernmental Panel on Climate Change (IPCC), *Climate change 2007: Synthesis report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Geneva: IPCC, 2007).

<sup>5</sup> Asian Development Bank (ADB) and Swedish International Development Cooperation Agency (Sida), 'Accounting for health impacts of climate change' (Manila: ADB and Sida, 2011).

challenges to society, physical infrastructure and water quality<sup>6</sup>, all of which would pose serious obstacles for CLVDT's development in the future.

To cope with and mitigate these risks, impact assessments of natural disasters and climate change for CLVDT are required. This paper does not attempt to provide a comprehensive scientific analysis of the environment and climate change in CLVDT, but focuses on analysing the effects of natural disasters on agricultural production activities in the area. As losses in terms of agricultural productivity (such as rice and paddy fields and livestock) and infrastructure, as well as farmer's lives in recent years indicate, flood and drought events have adversely affected agricultural production. The paper also summarises and reviews initiatives taken by the governments of Cambodia, Laos and Vietnam to deal with the problem, and discusses the roles of non-governmental organisations (NGOs) and local people's experiences in responding to such hazards. Finally, recommendations and solutions to adapt to and mitigate the impacts of natural disasters on agricultural production activities in the region are proposed.

The first section sheds light on the significance of the agricultural sector in the development of CLVDT in terms of economic growth, food security and employment, and establishes that CLVDT, in general, and the three provinces of Ratanakiri (in Cambodia), Attapeu (in Laos) and Kon Tum (in Vietnam), in particular, are predominantly dependent on agricultural production.

### **Agricultural Sector and Socioeconomic Development in the CLVDT Area**

At the regional level, the agricultural sector has made the biggest contribution to economic growth in CLVDT. With a proportion equivalent to 50.4 per cent of gross domestic product (GDP), the area's agriculture sector has always played a key role, making bigger contributions than its industrial and service sectors.<sup>7</sup> At the national level, agriculture in the CLVDT provinces of Cambodia (CLVDT-C), Laos (CLVDT-L) and Vietnam (CLVDT-V) accounts for 54 per cent, 48.1 per cent and 49.2 per cent, respectively, of their national GDPs in 2008.<sup>8</sup> In comparison with CLVDT-C and CLVDT-L, the agricultural sector of CLVDT-V has developed more due to the production of agricultural commodities, which focuses on major products, such as coffee, tea, pepper and cashew nuts. The study showed that, in Kon Tum province, the agricultural sector has been a primary contributor to the province's economic growth in recent years. For instance, the average growth rate of agricultural, forestry and fisheries production for this province during 1996–2008 was 8.05 per cent.<sup>9</sup> This can be attributed to the large agricultural land of the province<sup>10</sup>, which has facilitated the formation of specialised areas of perennial crops, livestock and fisheries, helped to create products of high quality and concentrated goods that have the ability to

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<sup>6</sup> Intergovernmental Panel on Climate Change (IPCC), *Climate change 2007*, op. cit.

<sup>7</sup> In 2008, the agricultural sector still held a high proportion of 50.4 per cent in comparison with 65.2 per cent in 2002. See more: Cambodia-Laos-Vietnam Development Triangle Portal, 'Development Features and Conditions', [http://clv-development.org/portal/page/portal/clv\\_en/817911/Tab2](http://clv-development.org/portal/page/portal/clv_en/817911/Tab2)

<sup>8</sup> Ibid.

<sup>9</sup> People's Committee of Kon Tum province, 'Synthesis report: The action plan for responding to climate change in Kon Tum province' (unpublished, 2011).

<sup>10</sup> According to 2012 statistics, the production area of agricultural land in the Kon Tum province was 214,855 hectares (ha; or, holding 22 per cent of total land fund) while the forestry land area was 641,055 ha (accounting for 66 per cent of total land fund). See, Kon Tum Statistical Office, *The statistical yearbook of Kon Tum province* (Kon Tum: Kon Tum Statistical Office, 2012), <http://thongkekontum.gov.vn/an-pham-thong-ke.aspx?id=5>

compete in foreign markets. The total value of agricultural production in Kon Tum province increased to approximately USD 308 million in 2012.<sup>11</sup>

The economy of the north-eastern provinces of Cambodia is largely dependent on the agricultural sector, which, for instance, accounted for 54 per cent of its GDP in 2008.<sup>12</sup> The food manufacturing sector employs a large proportion of people in the provinces of Ratanakiri, Stung Treng, Kraitie and Mondul Kiri, among which Stung Treng is the largest in terms of food production. In Ratanakiri province, in addition to food crops, industrial crops (such as, rubber, cashew nuts and coffee) have been widely planted. Similarly, the economic growth of the four southern provinces of Laos, namely Attapeu, Saravan, Champasak and Sekong is mainly based on agriculture and forestry production. In Attapeu province, GDP growth has averaged 7 per cent in recent years, with the contribution of the agricultural sector being 50 per cent and the shares of industry and services at 26 per cent and 24 per cent, respectively.<sup>13</sup> The forest plays a particularly important role in the agricultural sector in Attapeu and are priority areas in the local government's development plans, as nearly 20 types of non-timber forest products are main export commodities for Laos.

Besides, the agricultural sector has also contributed to ensuring food security<sup>14</sup> in the region. Rice and cassava are the two main food crops. In the north-eastern provinces of Cambodia, food crops production has gradually met local needs and even been exported. In particular, rice production reached a small surplus of 135,513 tonnes in 2012 and approximately 80 per cent of cassava crops have been exported to the world market.<sup>15</sup> In CLVDT-V, especially the Kon Tum and Gia Lai provinces, cassava is the most important food crop for export or for processing into livestock feed. In the CLVDT-L provinces, rice output has increased rapidly since 2005 to over 67,800 tonnes in 2010<sup>16</sup>, and it has become one of the major export crops. Beside rice crops, farmers in the CLVDT provinces also plant cash crops, such as maize, sweet potatoes, mung beans, soybeans, peanuts and vegetables. These crops not only meet food needs but also provide significant income.<sup>17</sup> It should be noted that, in recent years, agro-industrial plantation, including cassava, sugarcane and rubber, has been expanded dramatically in the CLVDT provinces.<sup>18</sup> These industrial crops have become the main products for export, especially in CLVDT-V's Gia Lai and Kon

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<sup>11</sup> Ibid.

<sup>12</sup> Ibid.

<sup>13</sup> Lao Statistic Bureau, <http://lsb.gov.la>

<sup>14</sup> At the World Food Summit of 1996 in Rome, the concept of food security was defined as existing 'when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life'. According to this understanding, food security needs to ensure both physical and economic access to food that meets people's dietary needs as well as their food preferences.

<sup>15</sup> Cassava production has risen about 10 times during the 2000s from just 200,000 tonnes in 2002 to above 2 million tonnes in 2006. For more information, see: Sau Sisovanna, 'The Cambodia Development Triangle area', in *Five Triangle areas in the Greater Mekong Subregion*, ed. Masami Ishida (BRC Research Report No. 11, Bangkok: Bangkok Research Center [BRC] and Institute of Developing Economies-Japan External Trade Organization [IDE- JETRO], 2012), 76.

<sup>16</sup> Vanthana Nolintha, 'Triangle area development: Prospects and challenges for Lao PDR', in *Five Triangle areas in the Greater Mekong Subregion*, op. cit., 133–68.

<sup>17</sup> Masami Ishida, ed., *Five Triangle areas in the Greater Mekong Subregion* (BRC Research Report No. 11, Bangkok: Bangkok Research Center [BRC] and Institute of Developing Economies-Japan External Trade Organization [IDE- JETRO], 2012).

<sup>18</sup> The industrial crops planting area increased dramatically in recent years. In Ratanakiri province, the total cultivated area for crop plantation has more than half of the total agricultural area while paddy rice accounts for less than half the area. See, Sisovanna, 'The Cambodia Development Triangle area', op. cit.

Tum provinces, which are the largest producers of coffee, cassava and rubber in the area.<sup>19</sup> The revenues from the export of agro-industrial crops, in turn, help to ensure that local people's needs are met.

From this perspective, the reason why the three governments have expanded agro-industrial plantation areas in CLVDT is partly to increase demand for such crops in the international markets and improve land quality, farming techniques and irrigation. For instance, during a survey in Ban Lung city in Ratanakiri, a Vietnamese businessman investing in rubber production on a very large scale suggested that the type of land in Ratanakiri was very suitable for growing rubber and labour costs were reasonable (Figure 1). His company has invested about 1,000 hectares (ha) in rubber since 2010 (Figure 2), and these areas will be ready for harvest by 2017. In this case, agro-industrial cultivation projects in Ratanakiri have not only helped make use of the comparative advantages of the province but also promoted business cooperation in the area.

*Figure 1: Author interviewing Mr Dang Van Hung, a Vietnamese entrepreneur from Ratanakiri province.*



*Credit: Author.*

*Figure 2: Rubber plantation in Ban Lung city, Ratanakiri province.*



*Credit: Author.*

Apart from these food crops and industrial crops, non-timber forest products have played a critical role for poor families. Interestingly, about 85.3 per cent of households in Ratanakiri province earn their living by forestry activities.<sup>20</sup> Local

<sup>19</sup> Binh Giang Nguyen, 'Cambodia-Laos-Vietnam Development Triangle: A view point from Vietnam', in *Five Triangle areas in the Greater Mekong Subregion*, op. cit., 99–132.

<sup>20</sup> Provincial Department of Planning, 'The Provincial Profile Based on Village and Commune Profiles: December 2007' (Ratanakiri: Provincial Department of Planning, 2008).

residents collect non-timber forest products, such as bamboo, mushrooms, leaves, aquatic products and medicinal plants. These products are used directly by local people or collected and sold in the market. Thus, the income source of local people has become more diversified.

Most people in the region engage in agricultural activities. In four southern provinces in Laos, the number of households that were engaged in agricultural activities increased by 16 per cent between 1998 and 2010 (from 136,000 households to 157,500 households).<sup>21</sup> In Attapeu province, the proportion of households engaged in agricultural activities has significantly increased by 29 per cent during the same period (from 14,800 households to 19,100 households).<sup>22</sup> In Vietnam's Kon Tum province, the proportion of labour involved in agricultural and forestry production was always over 50 per cent between 2009 and 2012.<sup>23</sup> For instance, in 2012, 139,480 workers from a total of 226,221 workers in the province were agricultural workers.<sup>24</sup> For the north-eastern provinces of Cambodia, the average rate of labour force engaging in agricultural activities occupies 81.28 per cent, which is higher than the national average.<sup>25</sup>

While the agricultural, forestry and fisheries sectors have played an important role in this region, their productivity remains low. The common practice for agricultural production has been to mainly use practical experiences along with old traditional community techniques and technologies. Besides, the system infrastructure for agricultural production is also very limited. Many areas in the region can only cultivate one crop per year since insufficient water is provided by the irrigation system or there are transportation difficulties due to poor quality roads. The livestock sector is still underdeveloped due to lack of diversification of livestock breeds and the focus on traditional breeds, such as buffaloes, pigs and cattle. In addition, domestic animal feeding is still small and dispersed without concentrated investment due to which production quality and efficiency of the sector is low. These vulnerabilities partly point to the factors that adversely impact the sectors' output adversely.

One of the biggest challenges to developing the agricultural sector in the region are natural disasters. In the forthcoming section, the paper indicates the main types of natural disasters that predominantly occur in the area.

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<sup>21</sup> Steering Committee for the Agricultural Census, 'Lao census of agriculture 2010/11: Highlights' (Vientiane: Department of Planning, Ministry of Agriculture and Forestry, Agriculture Census Office, 2012), [http://www.fao.org/fileadmin/templates/ess/ess\\_test\\_folder/World\\_Census\\_Agriculture/Country\\_info\\_2010/Reports/Reports\\_4/LAO\\_ENG\\_REP\\_2010-2011.pdf](http://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Country_info_2010/Reports/Reports_4/LAO_ENG_REP_2010-2011.pdf).

<sup>22</sup> Ibid.

<sup>23</sup> Kon Tum Statistical Office, 'Population and labor', *The statistical yearbook of Kon Tum province*, op. cit.

<sup>24</sup> Ibid.

<sup>25</sup> Sisonvanna, 'The Cambodia Development Triangle area', op. cit.

## Natural Disasters in the Region

In Southeast Asia, some countries, such as the Philippines, Indonesia, Cambodia, Laos and Vietnam, are more vulnerable to natural disasters than others.<sup>26</sup> As Table 1 shows, the occurrence of disasters has become more frequent since 1990.

Table 1: Natural disasters in Cambodia, Laos and Vietnam, 1990–2009.

Country	Period		
	1990–1999	2000–2009	1990–2009
Cambodia	7	13	20
Laos	12	6	18
Vietnam	44	76	120
Total	63	95	158

Source: D. Guha-Sapir, R. Below and Ph. Hoyois, 'EM-DAT: The CRED/OFDA International Disaster Database' (Brussels: Université Catholique de Louvain), [www.emdat.be](http://www.emdat.be).

Flood and drought events are the most frequent natural disasters in the CLVDT. This is partly due to its climatic characteristics. The area is predominantly affected by the Southwest monsoon winds. Heavy rains are seen in summer and autumn, with the weather being comfortable, while water shortage and drought is common in winter and spring. The rainy season sees heavy and concentrated rains that can easily lead to flash floods, soil erosion and landslides. Flash floods and landslides usually occur quickly and unexpectedly, damaging the basin. For instance, the Ketsana storm in September 2009 caused historical flood in the area and seriously damaged the agricultural sector, infrastructure and farmer's lives.<sup>27</sup> On the other hand, in the dry season, severe water shortage and prolonged droughts result in dead trees and forest fires. For example, in January 2013, the water level of the Dak Bla River was the lowest in the past 37 years.<sup>28</sup>

Climate in the area has thus changed slightly and should be taken into consideration in future research efforts. The paper next focuses on assessing the impacts of floods and droughts on agricultural production activities in the area.

## Impact of Natural Disasters on Agriculture

It is widely recognised that the agricultural sector is vulnerable to natural disasters and other extreme weather events. These events hit local production and availability of food, contributing to rising food prices and destroying local livelihoods. It is, however, difficult to exactly assess the impacts of natural hazards on the agricultural sector at the regional level. It is also not possible to obtain information specific to communes or villages without undertaking systematic retroactive surveys, which would have been beyond the scope of this work. However, data on damage caused by natural disasters does exist, and therefore the paper analyses the effects of floods and droughts on agricultural production activities in recent years in terms of losses to

<sup>26</sup> Danilo C. Israel, 'Forecasting natural hazards and disasters in selected Southeast Asian countries: The need for cooperative action' (PIDS Policy Notes No. 2011-20, Makati City: Philippine Institute for Development Studies [PIDS], 2011).

<sup>27</sup> Ketsana was by far the most damaging and one of the most severe natural disasters in recent years. The system made landfall over Central Vietnam on the 29 September 2009 causing three-day rainfalls widely in excess of 600 mm, with 800–900 mm recorded in some provinces. The storm passed into northern Cambodia and southern Laos where accumulated rainfalls continued to exceed extreme thresholds causing widespread flash flooding.

<sup>28</sup> 'Salt water penetrates further inland in Mekong Delta', *Sai Gon Giai Phong*, 20 February 2013, <http://www.saigon-gpdaily.com.vn/national/society/2013/2/104196/>.

rice and paddy fields, livestock, and agricultural infrastructure systems as well as farmer's lives.

#### *Loss of rice and paddy fields*

Loss of rice stocks and paddy fields due to floods was the single most cited problem for villagers in past years. Storms have appeared more often recently at intensities never seen before, causing flooding and destruction of crops in arable cultivation areas, putting agricultural production at higher risk. As mentioned above, the Ketsana storm adversely affected provinces in CLVDT. According to the Vietnam Central Committee for Flood and Storm Control (CCFSC), Ministry of Agriculture and Rural Development (MARD), flooding and damage amounted to nearly 40,000 ha for rice and paddy fields, 55,000 ha for lost or damaged secondary crops, and 11,000 ha for flooded corn and sugarcane crops.<sup>29</sup> In Laos, the Ketsana disaster affected the five southern provinces of Attapeu, Salavan, Xekong, Savanakheth and Champasak. Disaster struck when household food stocks were at their lowest and farmers were preparing for the rice harvest, aggravating the economic damage suffered. In Attapeu province, damage caused by this flood has still not been quantified. However, according to the Laos government, total loss in the agricultural sector of these five provinces was the largest at 31 per cent, causing severe shortage of rice.<sup>30</sup> According to Mr Veng Sakhon, Vice Director of Department of Natural Resource and Environment, most agricultural damage arose from flash flooding along mountain rivers that washed away crops close to the banks.<sup>31</sup> He also revealed that, while previous floods had occurred annually in the province, most of them did not cause deaths. On the one hand, the floods caused widespread damage, but on the other, they also provided nutrition to plants and wildlife. Floods usually appear during the months of August, September or October, and last only three days. However, recent floods occurred unexpectedly, leading to greater losses of rice and livestock.

The agricultural sector in Cambodian provinces also suffered serious damage. According to the Cambodian government, the estimated damage caused by the Ketsana storm to rice crops was about USD 17 million.<sup>32</sup> In 2011, CLVDT was extremely affected by tropical depressions related to tropical storms Haima and Nock-ten in June and July. Floods at that time were considered to be the worst since 2000. According to Cambodia's National Community for Disaster Management (NCDM), an estimated 284,448 ha of rice and other crops stocks were lost.<sup>33</sup>

Similarly, droughts can cause not only lower production outputs for rice and other industrial crops but also complete crop failures. Many rice and industrial crops requiring more water have dried up or been completely lost in recent years. For instance, in Kon Tum, damage caused by the drought in 2011 included dried rice (total area, 1,470.6 ha; complete loss, 873.3 ha; recovered, 597.3 ha), and dried industrial crops and vegetables (total area, 958.02 ha; completely loss, 244.7 ha;

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<sup>29</sup> Mekong River Commission (MRC), 'MRC annual Mekong flood report 2009' (Phnom Penh: MRC, 2009)

<sup>30</sup> Ibid.

<sup>31</sup> Interview with Mr Veng Sakhon at Department of Natural Resource and Environment on 3 March 2014.

<sup>32</sup> Royal Government of Cambodia, 'Cambodia: Post-Ketsana disaster needs assessment' (Phnom Penh: Royal Government of Cambodia, World Bank, Global Fund for Disaster Risk Reduction [GFDRR], UN, Asian Development Bank [ADB], and Asian Disaster Preparedness Center [ADPC], 2010),

[https://www.gfdr.org/sites/gfdr/files/GFDRR\\_Cambodia\\_PDNA\\_2010\\_EN.pdf](https://www.gfdr.org/sites/gfdr/files/GFDRR_Cambodia_PDNA_2010_EN.pdf).

<sup>33</sup> Mekong River Commission (MRC), 'MRC annual Mekong flood report 2011' (Phnom Penh: MRC, 2015)

recovered, 713.32 ha).<sup>34</sup> In 2007, Lumphat village in Ratanakiri experienced its most severe drought from September to October, reducing the rice harvest to just 200 kg/ha compared to the usual harvest of 1.5 tonnes/ha.<sup>35</sup>

In Phum Buon commune of Ratanakiri province, where rivers and streams were the only water resource, all villagers surveyed opined that rivers generally became shallow and streams ran dry during the dry season. Inadequate irrigation for the rice fields has become more and more frequent, leading to heavy damages in terms of crop yields and livestock. There are also limited sources of clean water for the local people. Most households in the commune use containers or jars to store water during the rainy season (Figure 3), which they then use during the dry season for daily activities (such as drinking, bathing, cooking, sanitation needs, etc.).

*Figure 3: Water for daily use is stored in containers or jars (a and b).*

(a)



(b)



*Credit: Author.*

### *Livestock losses*

Although damage to rice stocks and paddy fields is a common, immediate and direct impact on households, most villagers agreed that it was losses to livestock that could precipitate livelihood insecurity.<sup>36</sup> In the CLVDT, for instance, farmers considered

<sup>34</sup> 'Population and labor', op. cit.

<sup>35</sup> International Organization for Migration (IOM), 'Mapping vulnerability to natural hazards in Ratanakiri: Final report' (Phnom Penh: IOM, 2009).

<sup>36</sup> The concept of livelihood security is defined as 'the adequate and sustainable access to income and other resources to enable households to meet basic needs. This includes adequate access to food, potable water, health facilities, educational opportunities, housing, and time for community participation and social integration'. Thus, a concept of livelihood insecurity could be interpreted as a situation where the above conditions are not met or, in other words, where households do not have enough income and resources to meet basic needs. See, Ian Wilderspin and Vivian Raksakulthai, *Mainstreaming disaster risk reduction and climate change adaptation (CARE International in Viet Nam) – A practitioner's guidebook* (Hanoi: Care International, 2009).

their family's buffaloes and cows as a safety net that they could resort to in times of emergencies – most households sold their livestock to cover losses and damages suffered during disasters.

Livestock production and animal husbandry has been seriously affected in the increasingly frequent floods that occurred in recent years. Following the Ketsana storm, the livestock industry of Kon Tum suffered serious damage. According to the Department of Agriculture and Rural Development (DARD), a total of 1,986 cattle and 17,222 poultry died and 15,000 tortoises were washed away.<sup>37</sup> Fish ponds over an area of 145.67 ha (Kon Tum city, 6.67 ha; Dak Ha district, 40.53 ha; Sa Thay district, 5 ha; Dak To district, 32.5 ha; Ngoc Hoi district, 20 ha; Dak Glei district, 25.4 ha; Kon Ray district, 4.35 ha; Kon Plong district, 0.26 ha; Tu Mo Rong district, 10.96 ha) were damaged.<sup>38</sup>

#### *Damage to agricultural production infrastructure system*

The impacts of these disasters to agricultural infrastructure included landslides at dams or embankments, serious damage and flooding at permanent irrigation canals and ditches, flash floods delaying construction and requiring protection and repair of projects, wastage of money and resources as well as delays in the supply of manufacturing materials. In Kon Tum province, in 2009 alone, 19.3 km of dams and embankments were eroded, 429 temporary irrigation works were washed away, 176 irrigation works were flooded/damaged, 127 permanent irrigation works were damaged, and 22 permanent irrigation works were broken. The total number of canals occupied was 102 km and concrete channels damaged was 13.1 km.<sup>39</sup>

Prolonged droughts reduce water levels in the major rivers, drying up irrigation works in Kon Tum province and lowering water levels in the Yaly hydropower reservoir, thus reducing the generating capacity of the hydroelectric power plant in Gia Lai province. Many rivers flowing toward the Southern Central region originate in Kon Tum (such as Ve River and Tra Khuc River toward Quang Ngai; Thu Bon River and Vu Gia River flowing toward Quang Nam and Da Nang) and for this reason, droughts in Kon Tum affect the water supply for provinces in these areas.

As shown above, CLVDT's agricultural sector is vulnerable to floods and droughts and these disasters have caused significant damage to agricultural production activities. The forthcoming section outlines how the agricultural sector in the region adapts to the impacts of such natural disasters.

#### **Adaptive Measures to Natural Disasters for the Agricultural Sector**

The negative impacts of natural disasters in recent years have significantly changed agricultural production activities in the CLVDT. In the agricultural sector, the Department of Agriculture at Kon Tum has been researching the breeding of new food crops and fruit trees that are: (i) capable of resisting pests; and, (ii) better resistant to droughts and flooding. The construction and development of appropriate planting structures that can withstand harsh environmental conditions capable of preserving local crop varieties, and establishing seed banks are important adaptations to climate change and natural disasters. Besides, the development of measures of advanced farming techniques, in accordance with the natural conditions

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<sup>37</sup> People's Committee of Kon Tum province, 'Report on situation of flood and storm prevention in 2009 and working plan for 2010', 2010.

<sup>38</sup> Ibid.

<sup>39</sup> Ibid.

of the region, has gradually been applied. Currently, the three provinces of Kon Tum, Attapeu and Ratanakiri are expanding the planting area of crops and short-term crops, such as vegetables, maize, beans and sweet potatoes. However, as these crops need much water, local people require to also have to change farming methods by undertaking moisture-retaining measures (such as covering and keeping plants wet) to ensure plant productivity.

In the forestry sector, CLVDT has a large forest area. However, the region has witnessed deforestation and forest clearing for the cultivation of industrial crops and the construction of hydropower plants for a long time. On the one hand, CLVDT has benefited from these projects and industrial crop plantation projects have contributed to ensuring local people's livelihoods. For example, the hydropower plants/projects supply adequate electricity for the production activities of local people, so that they can earn revenue by exporting products to neighbouring countries. On the other hand however, the development of these projects has also seriously destroyed forest areas, leading to partial destruction of ecosystems as well.<sup>40</sup> Therefore, in recent years, the protection and development of forests has become a priority for the local people. The three governments have set up a series of forest management and protection policies, including land and forest assignment policies, agricultural stability and residential settlement, poverty mitigation and eradication. At the same time, encouraging and creating favourable conditions for indigenous peoples to earn profits from forest planting have also been taken into consideration. Yet, as the study revealed in Kon Tum province, such solutions face many difficulties and need time for effective implementation. Observations in Ngoc Hoi district, near the Bo Y international border<sup>41</sup> adjacent to Laos's Attapeu province or along the route from the Le Thanh international border to Ratanakiri province, showed that most forest areas have been turned into bare hills or converted into industrial crop planting areas for plants such as rubber, coffee, etc (Figure 4).

*Figure 4: A large area of forest cleared for the cultivation of industrial crops near Bo Y international border (a and b) and Attapeu province (c)*

(a)



<sup>40</sup> For more information, see: Ishida, *Five Triangle areas in the Greater Mekong Subregion*, op. cit.

<sup>41</sup> Bo Y International Border, which is located in the Ngoc Hoi district, is an important gateway for Kon Tum province to expand investment and trade with the southern provinces of Laos and Cambodia's Ratanakiri province.

(b)



(c)



In the fisheries sector, the provinces are taking initial steps to implement diverse manufacturing technical innovations and technologies for aquaculture production. For instance, in Kon Tum, local authorities are conducting a pilot co-management programme for aquaculture on a small scale, building management capacity and regulations with the local community's participation. Fisheries management has been implemented in a sustainable manner. In some lakes in Kon Tum, such as Yaly, fish cage farming has been developed for fish varieties, such as catfish, goby, red fish, etc. However, these fish cages need to be designed to withstand bad weather.

#### **Institutional Frameworks for Responding to and Limiting Natural Disasters in the CLVDT Area**

The following section reviews institutional frameworks for natural disaster management in the CLVDT at various levels of government.

### *At the intergovernmental level*

Institutional cooperation and coordination in response to and for reducing natural disasters between the three governments in the CLVDT area has not yet been formulated, with cooperation focusing only on matters such as transportation and communication, energy, and the development of border areas for commercial development and investment. However, a number of collaboration programmes, initiatives and solutions to respond to and mitigate the impacts of natural disasters have been made by these governments through other institutions and mechanisms in the region. In Asia, Cambodia, Laos and Vietnam are members of the Regional Consultative Committee on Disaster Management (RCC), which runs the Program on Mainstreaming Disaster Risk Reduction into Development (MDRD) Phase I (2004–2007) and Phase II (2008–2012). In ASEAN, Cambodia, Laos and Vietnam are also involved in various programmes, such as the ASEAN Regional Programme on Disaster Management (ARPDM; 2004–2010) and the subsequent ASEAN Agreement on Disaster Management and Emergency Response (AADMER) that was signed by ASEAN member states in 2005; as well as the Standard Operating Procedure for Regional Standby Arrangements and Coordination of Joint Disaster Relief and Emergency Response Operations (SASOP). Additionally, the three countries participate in the Greater Mekong Subregion<sup>42</sup> (GMS) framework that considers the development of agricultural and rural development as one of nine main areas, of which the tenth – water resource management and flood prevention – is identified as one of 11 priority programmes within the the cooperation framework. These three countries are also members of the Mekong River Commission<sup>43</sup> (MRC), which is an intergovernmental body formed by the countries of the Mekong basin. The MRC supports member countries in the following five areas: (i) flood management and mitigation programmes, including the establishment of MRC Regional Flood Management and Mitigation Centre (MRC-RFMMC); (ii) structural measures and flood proofing; (iii) enhancing cooperation on transboundary flood issues; (iv) flood emergency management strengthening; and (v) land management.<sup>44</sup> To date, the Flood Forecasting and River Monitoring System in the MRC has played an important role in providing timely and accurate river forecasts to its member countries in order to reduce vulnerability to floods and droughts in the Lower Mekong basin. Under the system of 138 hydro-meteorological stations at 23 forecast points, flood and drought forecasts are conducted and updated daily.<sup>45</sup> Furthermore, the MRC has also created the Climate Change and Adaptation Initiative (CCAI) to adapt to the impacts of climate change. Focusing on building capacities for local governments and local communities, the MRC's initiative is believed to enhance

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<sup>42</sup> In 1992, with assistance from Asian Development Bank (ADB), six countries (Cambodia, People's Republic of China [PRC; specifically the Yunnan province and Guangxi Zhuang Autonomous Region], Laos, Myanmar, Thailand, and Vietnam) entered into a programme for subregional economic cooperation that was designed to enhance economic relations among the countries. With support from ADB and other donors, the Greater Mekong Subregion (GMS) programme helps with the implementation of high-priority subregional projects in transport, energy, telecommunications, environment, human resource development, tourism, trade, private sector investment and agriculture.

<sup>43</sup> Since its establishment in 1995, the Mekong River Commission (MRC) has strived to develop work programmes and strategies that best serve its mission to provide effective support for sustainable management and development of water and related resources.

<sup>44</sup> Mekong River Commission, 'Flood Management and Mitigation Programme', <http://www.mrcmekong.org/about-mrc/programmes/flood-management-and-mitigation-programme/>

<sup>45</sup> Ibid.

the adaptive capacity of the region and contribute to region-wide networking on climate change adaptation planning and implementation.

In general, therefore, the three governments are involved in many mechanisms and initiatives aimed at responding and adapting to natural disasters and climate change. However, direct coordination among the three governments under the CLVDT mechanism has not yet been considered.

#### *At the national level*

At the national level, the central governments of each country view natural disasters as a critical problem. All three countries have a national strategy on the prevention and mitigation of negative impacts of natural disasters that has been integrated into their master development plan. Vietnam and Laos have long-term strategies for disaster risk management (DRM) programmes while Cambodia has just launched a short-term strategy.<sup>46</sup> In terms of operational structure, all three countries have national committees for disaster management that are responsible for making DRM policies at the national level. Among the three countries, Vietnam has already built a fairly developed disaster response mechanism, especially the disaster early warning system. However, the predictability and adaptive capacity of Laos and Cambodia still remains to be seen.

#### *At the provincial level*

At the provincial level, local governments are assigned to perform detailed measures under the national programme on the prevention and mitigation of the impacts of natural disasters. Provincial committees for disaster management have been established and are governed by the province's governor. Authorities are allowed to propose their own plans to prevent and mitigate natural disasters in accordance with their economic and social contexts as well as to attract other financial resources with the approval of the central government. However, in the case of Ratanakiri in Cambodia, disaster risk reduction has still not been mainstreamed into its development plan, which might be an important challenge for Ratanakiri's sustainable development in the coming years.

#### *At the local level*

Apart from the central and local governments, local people in the region are also involved in responding to the impacts of natural disasters. The use of indigenous knowledge – practical experiences in detecting and responding to natural disasters that have been handed down from generation to generation among local people – is a more useful and feasible option. However, how can indigenous knowledge contribute to the detection, adaptation and response to natural disasters as well as to guaranteeing sustainable livelihoods for the local people? When asked the above question during fieldwork, individual households in Vietnam's Kon Tum province revealed the local strategies in place for early warning systems in the event of natural hazards. Local people noted that they could predict an incoming flood based on changes in the river, such as if the river water turns red in colour with white foam

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<sup>46</sup> Laos was the first country to make disaster management plan among the three countries. In 2003, the Laos government adopted a Strategic Plan on Disaster Risk Management (SPDRM), which was followed by Vietnam adopting the National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020 in November 2007. Finally, Cambodia introduced the Strategic National Action Plan on Disaster Risk Reduction (SNAP-DRR) in March 2009.

floating on top, and if the water levels fluctuate. In Cambodia's Ratanakiri province, when asked the same question, the local people in Phum Buon commune shared that, if they saw the tail of Trokut (a type of lizard) change colour to black or when the nets of Trech (a type of red ant) were located higher on the tree tops, they took these as tell-tale signs of a flood occurring soon. On identifying these signs, local people warned each other to take precautions to minimise the negative effects of natural hazards. Indigenous knowledge also provided practical experiences to the local people that helped them adapt to changes in the surrounding environment. In fact, local communities and ethnic groups in this region have faced these challenges for many years. For the local people, with their practical experience, adapting to changes following natural hazards would include solutions such as planting appropriate crops suitable for drought and flood conditions, finding alternative food sources (e.g., shifting from farming to fishing when the flood season arrives), or relying on a reciprocal system that provides funds from family and friends for assistance in the aftermath of natural disasters.

## **Challenges in Adapting to and Mitigation of Natural Disasters**

### *Inadequate and ineffective operational institutions*

Although Cambodia, Laos and Vietnam have national programmes for the prevention and mitigation of natural disasters, DRM has yet to be institutionalised as law. In the last few years, the mechanism for operating and implementing activities related to DRM has been based only on the contents of national programmes. This has led to a number of difficulties in the implementation of relevant programmes, especially in operational mechanisms. For example, at the provincial level, operational mechanisms of the local authorities on natural disasters prevention are not clear, with much overlapping and lack of interdepartmental coordination. Helpful recommendations have not yet been made and neither have any constraints or measures been put in place to handle responsibilities of the parties involved. For instance, in Vietnam, the CCFSC is the agency responsible for activities of disaster risk mitigation. However, its ability to mobilise cooperation among relevant ministries and agencies is very limited because it is only a unit of the MARD. Legislative and organisational gaps are therefore very large because the DRM programme has not been converted into law for this area.

Although the three countries do participate in various programmes and initiatives at the intergovernmental level, there is limited and inefficient coordination in the process of adaptation to natural disasters. Most of these programmes only generally mention DRM, without specific mention of the various sectors, such as the agricultural sector. For instance, the framework of the national strategy for prevention and mitigation of natural disasters in Vietnam in 2020 only focused on disaster management related to water resources, with a focus on disaster response rather than prevention and fighting.

### *Limited availability of resources*

Another key challenge is the lack of available resources, which has led to low DRM capacities at all levels. Collection of information on this issue was beyond the scope of this study. However, during the field study in the three provinces, it was found that most staff concurrently undertook other jobs instead of concentrating on their main duties of irrigation and dyke management. Data systems meant to identify, assess and monitor disaster risks in this region were not fully functional. Although disaster risk maps have been designed for some villages and districts, they are rather sketchy, and many provinces have no disaster risk maps yet. For areas that have

disaster risk maps, these primarily focus on disasters related to water resources without comprehensive information. The norms and standards have not been set for the integration of risk mitigation measures during disaster recovery and reconstruction after disasters. The effectiveness of the national meteorological and hydrological services is limited. The same applies to the adaptability of local people in the region, especially that of ethnic minority communities. While indigenous knowledge is important when responding to disasters, such know-how is only orally transmitted and not properly documented. Moreover, many indigenous experiences are not tailored to evolve and adapt in response to environmental and social changes.

Most farming households in Phum Buon village of Ratanakiri province were poor. Many households did not have land to cultivate, working instead for other households. Their adaptability was mainly based on life experiences transferred as inheritance from earlier times. However, such experiences were dispersed and non-systematised, and therefore need further evaluation. The involvement of civil and social organisations in the prevention and mitigation of natural disasters in the provinces was still very limited. Thus, the participation of all parties is required for its successful implementation.

### **Recommendations**

The following recommendations, which focus on activities that can be undertaken by all stakeholders (from the intergovernmental level to government level as well by researchers), may be mainstreamed into actions to be undertaken at the institutional and operational levels.

Firstly, the central governments of Cambodia, Laos and Vietnam need to strengthen coordination in forecasting, preventing and mitigating the impacts of natural disasters through common initiatives, such as: (i) creation of international committees or organisations for responding to natural hazards and disasters; (ii) enhancing information and data sharing on natural disaster events; (iii) building capacity of stakeholders and local authorities for the assessment of impacts; and, (iv) designing coping strategies and adaptation measures.

Secondly, there is a need to attract more funds from other sources, such as civil society organisations, NGOs and small- and medium-sized enterprises, in the process of adaptation to and mitigation of the impacts of natural disasters on agricultural production activities. More focus should be placed on investments in modern technology advancements, as well as improving the national meteorological and hydrological services of these countries. Apart from modern technologies, indigenous knowledge and experiences on adaptation to natural disasters should also be collected and synthesised in order to minimise negative impacts on agricultural production activities. Besides these, raising the awareness of local people for improving agricultural production methods that are capable of adapting to natural disasters will be critically necessary in the coming years.

Finally, it is necessary to conduct more studies on risks and vulnerabilities posed by other extreme weathers and climate change to enable a comprehensive assessment of related challenges. These studies would contribute to determining a master plan for agricultural sector development in the CLVDT and ascertain implications on the livelihood strategies of local communities.