EMERGING TRANS-BOUNDARY ENVIRONMENTAL AND WATER ISSUES IN THAILAND'S PROVINCE OF CHIANG RAI AND IMPLICATIONS FOR ASEAN

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Abstract

Trans-boundary issues, especially related to shared environment and natural resources, have been increasing in both type and complexity, with more global and regional integration tendency. ASEAN is not an exceptional case, where many on-going issues are still persisting or even getting worse, and additional issues or re-emergences of old issues are expected as well, under the regional planned agenda to be more united and connected. Such trans-boundary issues become a real challenge for a new ASEAN community with diverse interests to address both from within and beyond. The challenges can be seen also from the overall lack of both update data and research together with inherent knowledge uncertainty to understand such complex trans-boundary issues. This paper aims to focus on the emerging trans-boundary issues as faced in the border province of Chiang Rai in Thailand as illustrative cases for ASEAN to deal with. These cases are trans-boundary droughts and floods related to the Mekong river that have recently affected Chiang Rai and are likely to have certain relations with upstream dam cascades, among other partially contributing causes. Several research studies were conducted earlier on these issues but only for specific cases further downstream and not yet up to date. So, the main purpose of this study is placed more on up-to-date positioning situation analysis of these trans-boundary water issues which serve as new starting points for further in-depth research and policy formulation studies. It is however interesting to find out additional evidences to indicate that upstream dams are among likely causes of droughts and floods, especially in immediate downstream countries. Discussions on further needs for both data and research as well as regional and national policy implications for addressing such emerging trans-boundary multi-disciplinary complex issues in the context of ASEAN integration are also provided for multi-lateral and comparable interests.

Keywords: droughts and floods from upstream dams, trans-boundary issues, dynamic and uncertain changes and adaptations, ASEAN.

Introduction

Trans-boundary issues, especially related to environment and natural resources, have been increasing in both type and complexity with global and regional integration tendency. ASEAN is not an exceptional case, where many on-going issues are still persisting or getting worse, such as deforestation and landuse change, and trans-boundary haze smoke and trans-boundary droughts and floods (Bach and Sirimongkalertkal 2011; Oanh and Leelasakultum 2011), and additional issues (emerging from such as easier movement of goods and people within the region and beyond) or re-emergence of old issues (such as malaria) are expected as

well, along with the regional agenda to be more united and connected. Such trans-boundary issues become a real challenge for a new ASEAN community with diverse culture and interests to address. The challenges can be seen also from overall lack of both update data and research together with knowledge uncertainty of complex trans-boundary issues.

This paper aims to focus only on the emerging trans-boundary water issues as faced in the border province of Chiang Rai in Thailand, namely the drought in 2010 and the flood in 2008 that are related to the Mekong river and likely to have certain relations with upstream dams in China among other contributing causes.

It is noted here that several researches were conducted earlier on these issues but rather limited and not up to date yet. For instance, more research studies were found on causes rather than from dams, such as landuse and climate changes (Zhao et al. 2010; He et al. 2009). There are various concerns that sediment trapping behind the dams and flow alterations may increase downstream bank erosion and reduce fish habitat downstream (Dore and Yu 2004; Quang and Nguyen 2003; Roberts 2001). Potential impacts from dams on river high and low flows are highlighted by Adamson et al. (2009), but there is no clear convincing evidence provided of such effects on the Mekong river.

Yet, public concerns are increasing from the media at all scales (local to regional and international) over possible causes from upstream dams Both government officials and civil society in the lower Mekong countries are very concerned about the potential for upstream developments to alter downstream river flows (Campbell 2009). For example, results from workshops, as documented in Campbell (2007), at which participants, mainly government officials from the four lower Mekong countries, were asked to identify the most significant trans-boundary environmental issues, clearly shows that "Dams and reduced dry season flows" was the second most serious issue identified after "water quality". It was identified as a serious issue in all five workshops from which data were available. This concern has been reflected in the popular media with low flows during recent droughts often being blamed on dams in China. For example, during the drought in 2004 and earlier, articles implicating Chinese dams as a causative agent behind changes to Mekong River flows appeared in a range of regional papers and online media (Asia Times Online 2002; Cambodianonline 2004; Samabuddhi 2004) as well as in newspapers in Australia and Britain (Vidal 2004), New Scientist (Pearce 2004), and elsewhere. Subsequently, follow-up articles have appeared frequently in the regional media (e.g., Bangkok Post 2005, 2006). However, an analysis conducted by the MRC (MRC 2004) concluded that, while there was evidence of hydrological impacts of Manwan dam in China on flow variability at Chiang Saen in Thailand, there was no evidence that the existing Chinese dams played any role in contributing to the 2004 low flows. The low flows became more extreme downstream, and were evidently caused by reduced wet season rainfall throughout the basin (Campbell 2009).

The most recent drought in 2010 has much more attention in the media, as well as in the expert community revolving around the MRC, the topic is bound to be addressed in a number of scientific publications in the coming years (MRC 2010a). Below is a partial list of additional concerns from the media in March and April 2010 sorted by time, at various levels, and with different levels of responses.

- March 4: Drought will worsen as temperature rises to 43C. (Bangkok Post)
- March 11: Drought in the Mekong Basin Hampers Southeast Asia Economy (Circle of blue: reporting the global water crisis)

- March 12: Severe Drought Puts Spotlight on Chinese Dams (Science, Vol. 327 no. 5971 p. 1311: News of the week)
- March 13: When the Mekong runs dry (Asia Times)
- March 18: Frustration on the Mekong: Falling water levels reveal the hidden shoals of mistrust (The Wall Street journal)
- March 24: Thai Officials Insist Chinese Dams Cause Mekong Drought (VOA Lao Service)
- March 25: Southeast Asia Drought Triggers Debate Over Region's Water Resources (Voice of America News)
- March 25: China reveals Mekong data in boost for drought response (Bangkok Post)
- March 30: Drought Drops Mekong River to 50-Year Low, Affects Farmers and Trade (Voice of America News)
- April 02: Thailand Facing Severe Drought along Mekong River (NTD TV)
- April 03: Experts Say Cooperation Needed on Mekong River Resources (Voice of America News)
- April 04: China Pressed for More Information on Mekong Dams (Voice of America News)
- April 12: Record Drought Exposes Water Woes (IPS, Inter Press Service News Agency)
- April 12: The Mekong and China: Dams and Trust (Vietnamnet)
- April 15: Mounting Tensions over the Mekong River (Caixin online)
- April 26: China debates whether human activity or nature is to blame for drought (Los Angeles Times).

However again, the main causes of water levels being experienced in the 2010 dry season in the Mekong mainstream are recognized by MRC (2010b) not directly in relation to upstream dams, but mainly a combination of early end to the 2009 wet season, low monsoon rainfall and very low rainfall in the dry season which together have led to regional drought conditions. Based on the available information it appears that flows from tributary rivers in Lao PDR and northern Thailand are at levels that are amongst the lowest recorded in recent decades. This situation represents a regional hydrological drought affecting all countries in the Basin. The higher than natural levels in the Mekong River experienced at Chiang Saen in early to mid-January resulted from hydropower operations upstream. These levels then reduced to levels closer to those of the usual conditions in late January as reservoir storage levels upstream fell in response to the drought (MRC 2010b).

An opposite view is, however, raised by a local group in Mekong Community Media Project in a booklet edited by Lamun (2010), which clearly claims that dams cannot control flooding, and, in the context of the climate change crisis, dams cause rivers to dry. So, the main purpose of this study is placed more on up-to-date positioning situation analysis of these trans-boundary water issues, which serves as a starting point for further in-depth research and more effective policy formulation from local to regional levels.

Methodology

Available data are collected from related reliable sources for analysis. The long-term tendency data for several decades on Mekong river water levels are extracted from the Mekong River Commission (MRC), while the short-term daily data for the last ten years are provided by Hydrology and Water Management Center of Chiang Saen (HWMC) in Thailand. Matching of data from these two sources has been checked to be consistent.

To assess possible causes of floods and droughts from upstream dams, several methods are combined for more insights; including temporal methods to relate the status of a series of upstream dams with drought and flood events and to identify recent changes through comparing long-term data series with recent short term data in order to identify unexpected changes of water level and discharge downstream during the drought and flood events in the study area, then to detect any coincidence before, during and after a cascade of upstream dams.

River water discharges upstream are unavailable, but are almost directly related to these downstream (especially at Chiang Saen station) as there are no major lateral flows (especially during the drought period) in this river reach. So data at Chiang Saen station will be used instead for detail analysis. In addition, a comparative study of the long-term trend and recent changes in rainfall patterns (especially in Chiang Saen station) is conducted to detect abnormalities in recent years to show climate change evidences, namely rainfall pattern changes for illustration that climate change is also a cause of drought.

In summary, data analyses for both spatial and temporal dimensions are conducted to identify emerging patterns and provide additional evidences of possible trans-boundary causes of drought and flood problems in Chiang Rai province. The outputs will be used as a basis for further policy implication analysis.

Results

A major obvious cause for floods and droughts in the Mekong river basin in Chiang Rai is the regional climate change which is reflected by extreme rainfall conditions both locally and regionally. However, there is another possible cause from upstream dams that are often controversial. In this connection, we have attempted to focus on the question on possible temporal correlations between upstream dams and downstream droughts and floods. It is noted that the Mekong river basin in Chiang Saen that is the first entry point from upstream to Thailand receives water from upstream up to 95% in dry seasons, and 70% in rainy seasons as generally understood (e.g., see MRC 2005).

To relate upstream dams to downstream drought and flood events, a series of upstream dams over time as provided in Table 1 is analyzed for discerning some coincidence. To the flood event in 2008 August, there are a total of three mainstream hydropower dams under operation to that point in time with a combined storage total/active being 3086/873 mcm. As a general safety rule, dams must release water when storages approach full capacity. Such releases if not properly managed in time and quantity can contribute to rapid water flow changes downstream. To the 50-year historical drought event in early 2010, there is another huge dam added, which is Xiaowan dam. This dam alone has a storage total/active being as high as 14,560/990 mcm (from its size of nearly 300 m in height and 920 m in width). One can imagine how much water to be stored theoretically in all these dams combined, and how much water to be kept to ensure a minimum level of water in the dams. The more water stored upstream, the less available downstream. Although no data are available on how much water is exactly stored and filled in the dams, cumulative coincidence in time is likely to be indicative of possible correlations between combined dams (and their operations rules and schemes) upstream and flood and drought events downstream. Such upstream data is really needed for further in-depth analysis.

Table 1: Status of existing and planned mainstream hydropower dams in the Lancang-Mekong cascade in Yunnan Province, PRC (January 2010).

Project	Status	Storage (MCM) total / active	Expected installed capacity (MW)	Commissioning
Manwan	operational	920 / 257	1500	1993-1996
Dachaoshan	operational	933 / 367	1350	2001-2004
Jinghong	operational	1233 / 249	1750	2008
Xiaowan	filling and commissioning stage	14560 / 9900	4200	2009-2011
Gonguoqiao	under construction	510 / 120	750	2012
Nuozhadu	under design	22400 / 12300	5500	2014
Ganlanba	under design	• / 0.2	150	Before 2025

Source: MRC (2009)

A comparison of water levels during the droughts in 1992/1993 (before any upstream dams construction and operation) and 2009/2010 (after the four dams in operations/commissioning) as shown in Figure 1 for Chiang Saen reveals several important insights. First, more frequent short-term (daily) fluctuations of water level are seen clearly during 2010 January, which results from the similar fluctuations of water discharges, as indicated in Figures 2 and 3. Such fluctuations in the dry month of no rainfall are related to upstream water releases and really create confusions for both aquatic organisms and human beings to adapt with.

In addition, as shown in Figures 2 and 3, the water level drops much steeper from the end of January to February in 2010 to reach the same low level in February in 1993, then continues to drop further to the lowest level of 0.98 meter on 20th February in 2010. It is interesting to note here that the rate of decline of water level during the three-week period (from 20th January to 10th February in 2010), after the Xiaowan dam, is much steeper than that in the same period in 2009 (see Figures 2 and 3 for more details), which corresponds to the steep decline of water discharge as indicated in Figure 3.

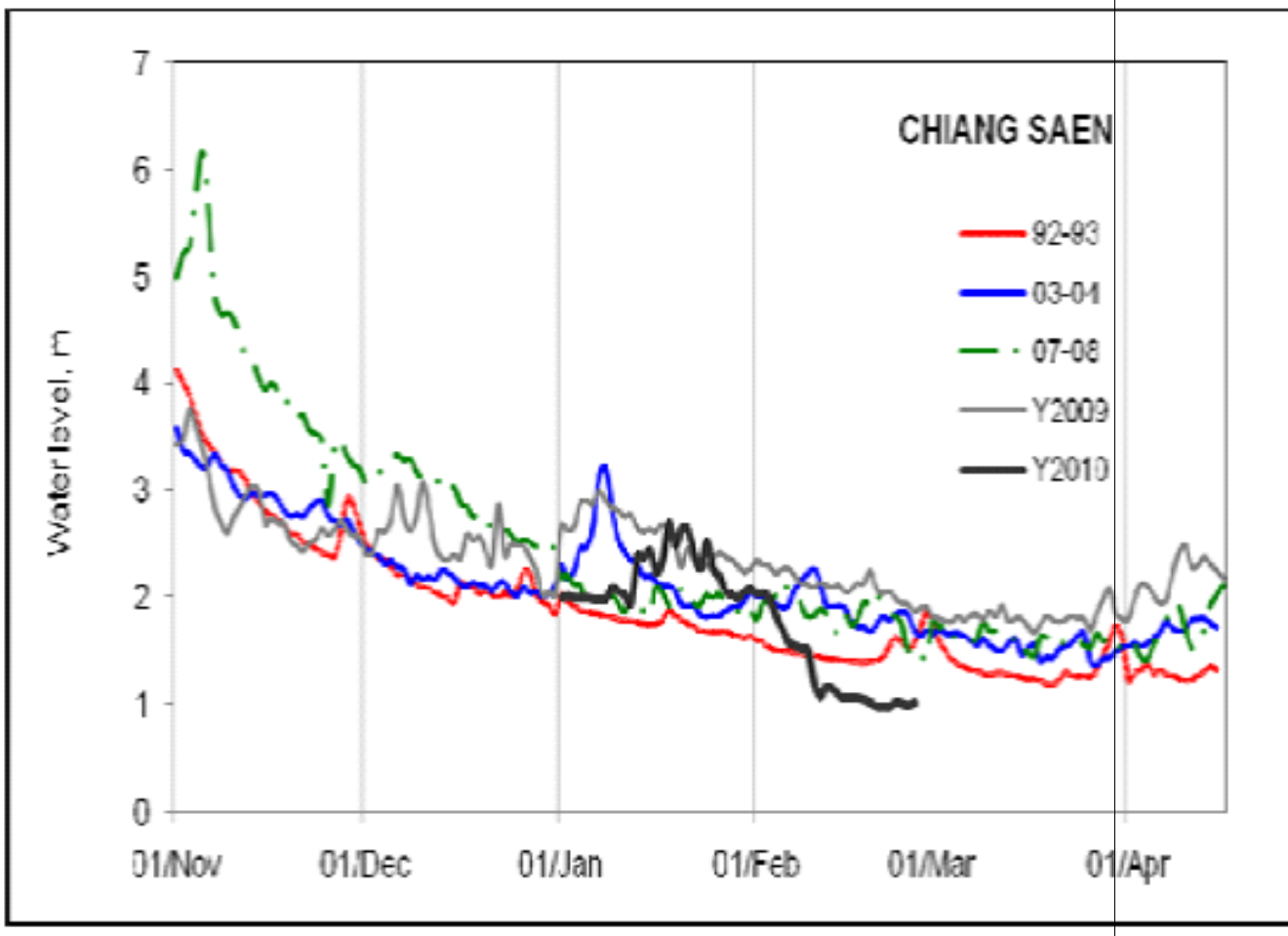

Figure 1: Lowest Water Level in 2010 Compared to Other Years.
Source: MRC (2010b)

Figure 2: Water Level in Dry Season (2009, 2010) at Chiang Saen.
Source: HWMC.

Figure 3: Water Discharge in Dry Season (2009, 2010) at Chiang Saen.
Source: HWMC.

Combined with extremely low rainfall conditions in the region during the drought months of 2009/2010, as widely recognized (MRC 2010b), and with an indication of no extremely heavy rainfalls before and during the flood peak in August 2008, it is implied that the immediate downstream water level (and fluctuation) at Chiang Saen station is considerably influenced by upstream flows from dams, as there are no other major lateral flows from upstream dams to Chiang Saen. Note again that discharges at Chiang Saen stations are largely dependent on discharges from the dams with only some phase lag in time (of a few days).

More investigations are however needed to better understand if and how upstream flows can be contributed to by other factors other than releases from upstream dams, such as snow melting, landuse change, and/or deforestation.

Besides upstream impacts, there may be other important causes from climate change. Because of time constraints, we have managed to check only if there are possible changes detected of rainfall patterns over time at Chiang Saen. The answer is affirmative indeed as shown in Figure 4 that compares the rainfalls in 2009 and 2010 with the historical long-term monthly average data from 1960 to 2004 and the recent monthly average (from 2001 to 2010). It is seen clearly that the rainfall at Chiang Saen station from June to December 2009 and to February 2010 is considerably much less than normal, and also ends earlier than normal, which makes a prolonged lack of rain. This below normal rainfall situation is another cause of the drought. In addition, it is also observed that the historical long-term monthly average data from 1960 to 2004 shows the monthly rainfall pattern with only a peak in August, but the recent monthly data from 2001 to 2010 clearly indicates rainfall pattern changes from one peak to two peaks, in addition to much larger deviations from the long-term average.

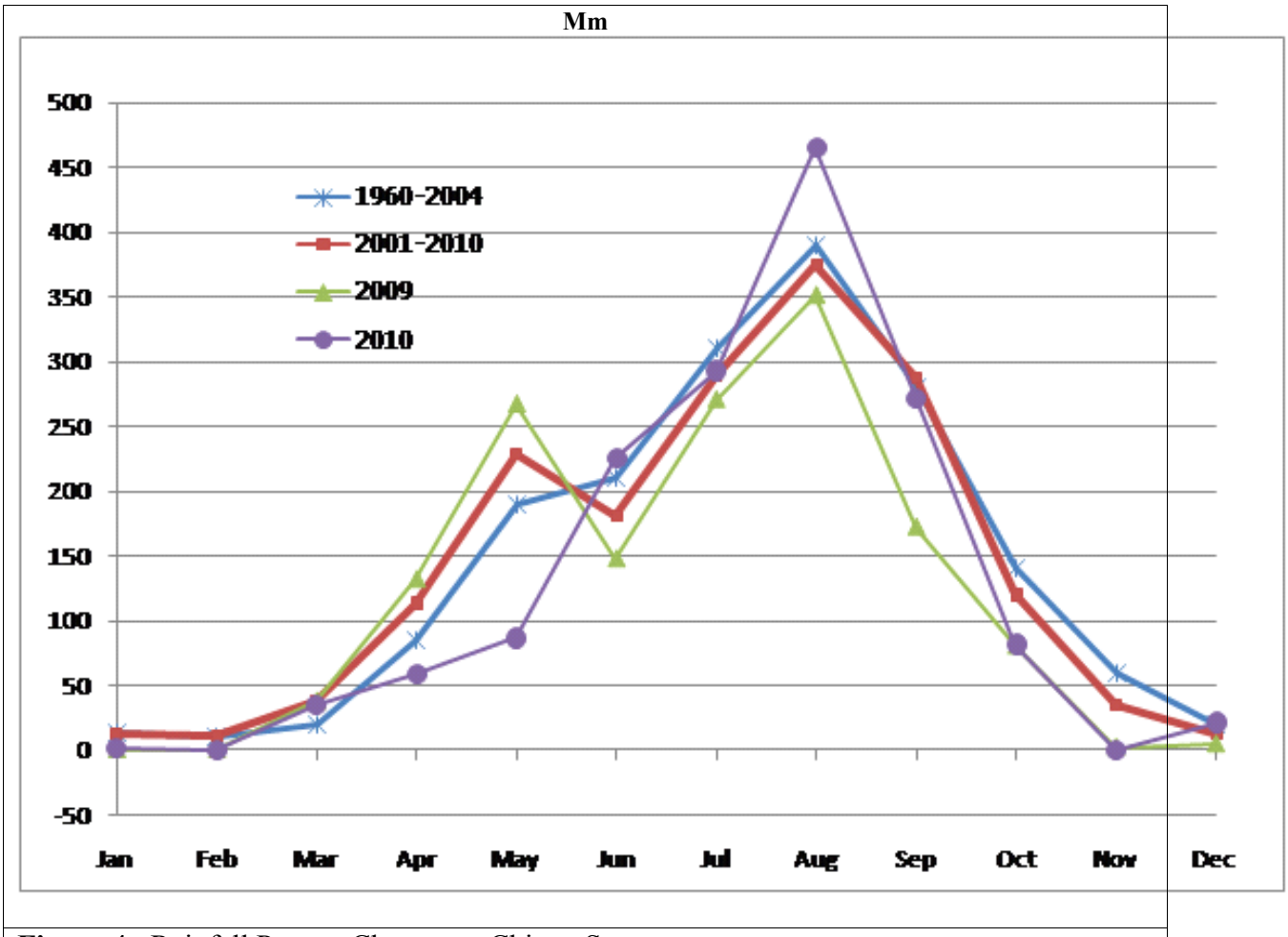

Figure 4: Rainfall Pattern Change at Chiang Saen.
Source: HWMC.

Discussion and Conclusion

This paper has illustrated, with additional update evidences, the emerging trans-boundary drought and flood issues facing Chaing Rai (Thailand) as on-going challenging example cases among many other trans-boundary cases for ASEAN to manage. The trans-boundary droughts and floods related to the Mekong river that have recently affected Chiang Rai are shown to be likely to have certain relations with upstream dams in China among other contributing causes. While some issues as smoke and haze are more internal issues within ASEAN, the dam-related floods and droughts are more external issues that are related with other non-ASEAN countries. Such trans-boundary issues become a real challenge for a new ASEAN community with diverse interests to manage both from within and beyond. The challenges can be seen also from the overall lack of both update data and research together with inherent knowledge uncertainty to understand such complex trans-boundary issues.

Some recommendations on trans-boundary water issues based on our research findings are provided herewith. First, continuous monitoring is really needed through more efficient mechanisms for transparent data sharing (upstream and downstream) so that more suitable adaptation plans for downstream target groups and sites can be developed accordingly. Here again, trans-boundary win-win cooperation spirits really need to be enhanced to go beyond blaming each other to address the trans-boundary river basin, especially under the context of climate change. Therefore, possible mitigation measures for upstream dams are strongly recommended in the dry season on ensuring minimum water flows in the downstream Mekong river, and on minimizing water fluctuations downstream to some extent acceptable by both upstream and downstream stakeholders; and in the flood reason on demonstrating the roles of dams in protecting downstream floods. These measures are not new as they have been adapted elsewhere in many trans-boundary rivers.

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