

ABSTRACT

Bunny Yorth for the degree of Master of Public Policy presented on June 2, 2014

Title: International Mekong River Basin: Events, Conflicts or Cooperation, and Policy Implications

Abstract Approved:

Bryan Tilt

Abstract

“International river basin is defined as an area extending over two or more states determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus” (Shapiro-Libai, 1969, p. 22). There are 276 international river basins providing almost 60% of global freshwater and supporting at least 40% of the world population. Over recent decades, the riparian governments of the Lancang-Mekong River, like other international river basin leaders, may have had different and sometimes conflicting interests in promoting their economies through exploiting shared water, preserving their aquatic resources, or both, in the basin. Accordingly, their interactions have created water events, which can be neutral, conflictive, or cooperative. In this secondary-data paper, there are seven levels of conflicts and seven levels of cooperation, ranging from -7 to -1 and from +1 to +7, respectively. The main discussions of this paper focus on frequencies in each level, outstanding factors found in either conflicts or cooperation of the events, and policy implications. The 190 events from 1952 to 2010 in the Lancang-Mekong River Basin are found to be overwhelmingly cooperative. The result means that six riparian governments – China, Burma, Laos, Thailand, Cambodia, and Vietnam – would like to work together. However, these nations will need to do more, especially relating to three outstanding factors found in the conflictive events: dam development, navigation projects, and droughts. In addition, memberships of both China and Burma are strongly needed in the Mekong River Committee (MRC).

Keywords: Mekong River, Water Conflict and Cooperation, and Water Policy

©Copyright by Bunny Yorth
June 2, 2014
All Rights Reserved

Master of Public Policy thesis of Bunny Yorth presented on June 2, 2014

APPROVED:

Bryan Tilt, representing Public Policy Graduate Program

Aaron Wolf, representing College of Earth, Ocean, and Atmospheric Sciences

Dwaine Plaza, representing Sociology Program

I understand that my thesis will become part of the permanent scholarly collection of Oregon State University Libraries. My signature below authorizes release of my thesis to any reader upon request.

Bunny Yorth, Author

**International Mekong River Basin: Events, Conflicts or Cooperation, and Policy
Implications**

by

Bunny Yorth

MPP Essay

Submitted to

Oregon State University

In Partial fulfillment of

the requirements for the

degree of

Master of Public Policy

Presented on June 2, 2014

Commencement in June 2014

Acknowledgements

This essay writing is the most lengthy and time-consuming process of all among my academic work at Public Policy Graduate Program, Oregon State University (OSU), USA. Along the way, I have been in an excellent program and met numerous amazing, talented, willing people, who have given me welcoming faces, courage, and comprehensive skills. Without each of them, I don't believe I could have gotten myself through from day one.

My first special thanks go to my essay committee: Dr. Bryan Tilt, Dr. Aaron Wolf, and Dr. Dwain Plaza. The committee chair and each of these members have been very helpful, accessible, and supportive. Their comments and guidelines inspire my successes. These special thanks also go to the whole Public Policy Graduate Program, HARVEST Program of the USAID in Cambodia, and Institute of International Education (IIE). The HARVEST Program, with coordination of the IIE in USA, sent my application to the OSU, where I met Dr. Brent S. Steel, who all times welcomes everyone, and his remarkable colleagues. It is my honor to mention Ms. Pich Chinda Sou (HARVEST Program) and Ms. Lindsay Hillenberg (IIE) by name.

I have been blessed and grateful to have so many caring and cooperative friends including my editing tutors during this academic endeavor and to get advantages of latest computer technologies such as online search, copy and paste, and you tube. Additionally, my academic debts and thankfulness go to researchers and scholars in my references.

Furthermore, I am especially thankful to my wife, Chhoamdalin Kuch; father, Kimleng Yorth/Neang Prak; and my parents-in-laws, Kuch Khun and Sotha Chhor. Unlike other families with many members, we are among the least but have committed for my brighter future and allowed me to pursue my dream of studying in this most wonderful country.

My final special gratitude goes to my late mother, Chan Boren, who deserves all credit from my entire work.

Contents

Abstract.....	1
Acknowledgements	5
I. Introduction	7
A. Dam Development.....	14
B. Navigation and Irrigation	17
C. Drought and Flood	19
D. Fisheries.....	21
E. The MRC and Development Cooperation	23
III. Research Objectives and Questions.....	26
IV. Data and Methods	28
1. Classification of Lancang-Mekong Basin Events	31
2. Temporal Trends and Outstanding Factors	39
3. Outstanding Factors and Policy Implications	43
A. Dam Development.....	43
B. Navigation Projects	46
C. Drought.....	49
D. Flood Management	52
E. Development Cooperation.....	54
F. Mekong River Commission/Committee (MRC)	56
VI. Conclusion	59
References	61

I. Introduction

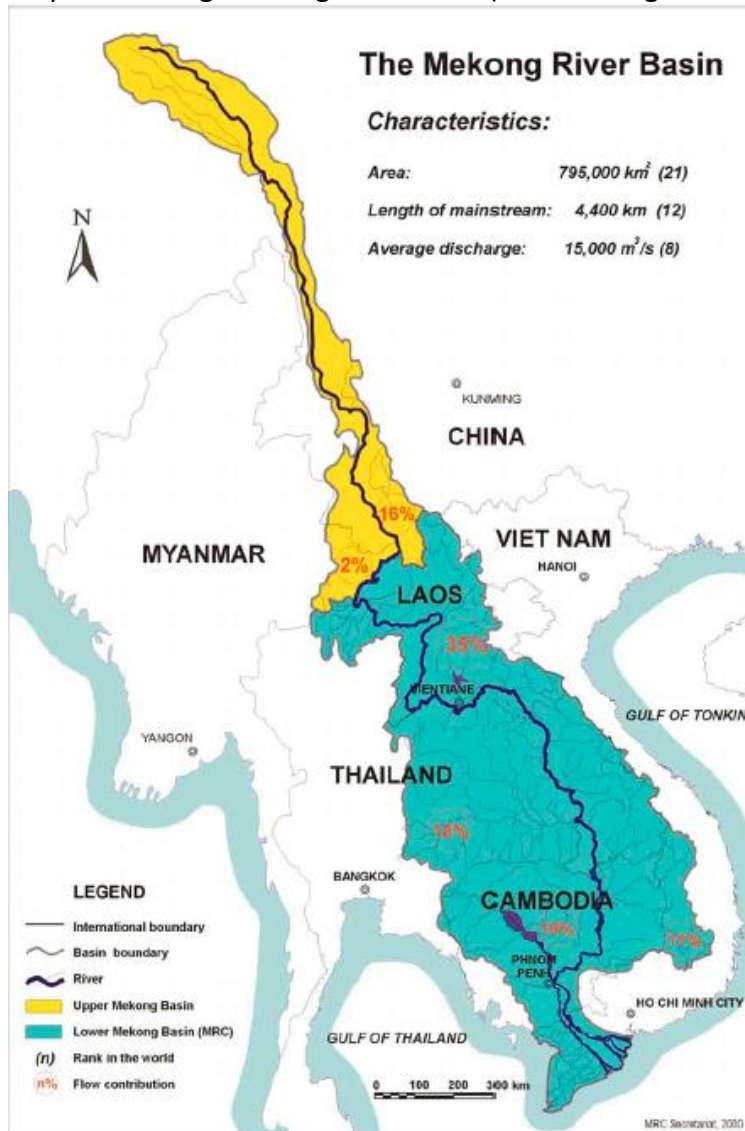
The Lancang-Mekong River Basin (Mekong River Basin) is the biggest and longest river in Southeast Asia and one of the most productive inland fisheries in the world. The basin is the third in terms of biodiversity, eighth in term of water discharge, and twelfth in term of length in the world (Ziv et al., p. 5609; ICEM, 2010, p. 26). Its origin is at the northeastern rims of China's Tibetan mountainous plateau, which is about 5,000 m above sea level. Blessed with steep valleys and a high elevation, this international basin gets water from snow, alpine springs, and rain falls. The river travels about 2,300 km through the Chinese Qinghai, Tibet, and Yunnan provinces before reaching five other countries. During its first 1,000 km, the river travels in a nearly southerly direction in rough parallel with the Salween and Yangtze Rivers, which originate in the same highland areas (J. Dore et al., 2012, p. 24). This part of the Mekong River is called Lancang (Jiang) River in China.

It is 400 m above sea level when it leaves China, snaking over another 2,600 km through Burma/Myanmar, Laos, Thailand, Cambodia, and Vietnam before terminating in the South China Sea. Lancang and the part of this Mekong River shared with Burma are called the Upper Mekong Basin (UMB) (in yellow of the *Map 1*) while the rest Lower Mekong Basin (LMB) (in blue of the *Map 1*) (MRC, 2000; Radosevich & Olson, 1999, p. 1). In the UMB, China and Burma share 16% and 2%, respectively, while in the LMB, Laos, Thailand, Cambodia, and Vietnam 35%, 18%, 18%, and 11%, respectively (MRC, 2000).

Water, wetland, and fishery resources from the whole river system are integral in supporting the livelihoods of some 260 million people in these riparian parts of the world, especially about 15 million at the UMB and another 61.2 million at LMB, who almost exclusively depend on this basin and its tributaries (Pearse-Smith, 2012, p. 149). Among

these 61.2 million is 90 percent of the population of Cambodia (13 million), 98 percent of the population of Lao PDR (5.2 million), 39 percent of the population of Thailand (23 million), and 20 percent of the population of Viet Nam (17 million in the Delta and 3 million in the Central Highlands) (Sokhem, 2011, p. 19).

Map 1: Lancang-Mekong River Basin (The Mekong River Basin)



MRC, 2000

Website: http://webworld.unesco.org/water/wwap/pccp/useful_links/mekong_maps.shtml

This international river basin has an annual average flow of 475,000 million m³, covering 795,000 m² in the whole region, and flooding 70,000 km² from July to October (Hortle et al., 10; Snidvongs et al., p. 11). Thus, the whole Mekong Basin is very rich in aquatic resources and fertilized land. These six riparian governments have an annual 3.9 million tons of fish catch and produce surplus rice and other agricultural products for exporting to international markets. This river has also allowed them to double the volume of cargo along the Mekong from China to Thailand since 2004 (Leitsinger, 2010).

This indicates that the Lancang-Mekong River Basin has been integral to livelihoods and economic developments. However, to manage this trans-boundary river among six nations with full independence and sovereignty has never been easy because the use of the river is reportedly contested since the early 1950s, and especially in the last two decades.

China has had strong interests in generating electricity from the Lancang River through dam developments and as well as clearing parts of the basin to improve navigation in the Upper and Lower Mekong Basin for trade. Burma, who seems to be cut off from the world and shares the Mekong River as a border with Laos, has been observed to be quiet but cooperative with China. Laos prefers to develop hydro electronic dams in the Mekong River in order to create more energy supply and to transform its energy richness into a battery of South East Asia.

Thailand demands more electricity supply from both China and Laos and diverts water from the Mekong main tributaries to irrigate its northeastern areas for agricultural cultivation and exports. Cambodia wants fewer structures such as large-scale dam and irrigation systems as possible in the Lancang-Mekong Basin because of its fish and aquatic species abundance. Vietnam chooses to build many dams in central Vietnam but expresses

objections to any mainstream dams because of potential negative impacts on its productive agriculture and aquaculture in Southern edge of Vietnam, which is in the Mekong delta.

The choices of each country can be very different, depending on natural endowment and interests in national development priorities. As the demand for water, according to Postel and Wolf (2000), approaches to meet the most possible supply, intra-national conflicts may increase (Eidem et al., p. 63). Kofi Annan (2001), the United Nations Secretary General from 1 January, 1997 to 31 December, 2006, warns that “Fierce competition for fresh water may well become a source of conflict and wars in the future” (Wolf, 2007, p. 241).

“[The] future quality of life in the region is strongly linked to the choices made about sharing, developing and managing water to: produce food and energy, maintain vital ecosystems, and sustain livelihoods” (J. Dore et al., 2012, p. 24). From 1952 to 2010, these six countries have participated in 190 water events, including treaties, agreements, etc. (TFDD). All these water events are coded and classified by Trans-boundary-Fresh Water Dispute Database (TFDD), Oregon State University.

This paper aims to explore, describe, and explain these 190 events. There are three objectives in this paper: the first objective is to group and explain each level of the events that are conflictive, neutral, or cooperative, using the Basins At Risk (BAR) Scale, which will be explained in detail below; the second objective is to construct temporal trends of all the events and to find outstanding factors that are associated with either conflictive or cooperative events; and the final objective is to provide policy recommendations based on literature review and findings so that these six countries will be mutually more cooperative and benefit from this international basin.

II. Literature Review

“International river basin is used to define an area extending over two or more states determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus” (Shapiro-Libai, 1969, p. 22). There are 276 international river basins covering almost 50% of world surface. They straddle international boundaries and provide some 60% of global freshwater, which supports at least 40% of world population (UNESCO). “Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment” (ICWE, 1992). “Water, unlike other scarce, consumable resources, is used to fuel all facets of society, from biologics to economies to aesthetics and religious practice. As such there is such thing as managing water for a single purpose – all water management is multi-objectives” (Wolf. 2007, p. 244).

This consumable good has its shapes and directions dictated by its containers, namely rivers, tributaries, canals, lakes, and human-made infrastructures. For thousands of years, people have been accustomed to unblocked natural and seasonal flows of shared water to support their cultivation, livelihoods, and community traditions. But Platt (2004) and Cortese (2003) claim that “water is increasingly being transferred away from agriculture to meet the needs of growing urban populations and in-stream uses, primarily habitat for endangered species”. Irrigation canals and infrastructure projects including dam constructions crisscross the land to exploit arid and unsettled regions for human settlement and to supply electricity for burgeoning cities (Eidem et al., 2012, p. 63).

Interests in prioritizing the use of the shared water by one riparian government may affect the opportunities of other riparian governments, creating externalities or common pool resources situations leading to international collective problems (Schmeier, 2009, p.

29). According to Vermon et al. (2010), “interests are what underlie stated positions and provide insight into needs, wants, desires, concerns, hopes, fears and values” (J. Dore et al., 2012, p. 25). Because different governments have different interests, the water events in this basin are socially, traditionally, and economically complex. They can be unrelated, related and/or entwined together even though they may change over time. These intriguing and opposing interests among international rivers can be remarkably observed throughout history.

Yoffe et al. argue that the most promising factors for water conflict are those associated with rapid or extreme physical or institutional change within a basin (e.g., large dams or internationalization of a basin) and the key role of institutional mechanisms, such as freshwater treaties, in mitigating such conflict (Yoffe et al., 2003, p. 1109). Therefore, hydro development namely dam development, navigation projects, and irrigation, are more likely to be conflictive.

While countries with unfriendly relationships are found to be unfriendly over water issues, countries that cooperate over water are generally cooperative on other issues as well. On this similar note, there are strong and compelling inducements in the shared water for dialogue and cooperation, even though there are hostilities ranging over other issues (Wolf, 2007, p. 243). Kofi Annan, in February 2002, argued that “... the water problems of our world need not be only a cause of tension; they can also be a catalyst for cooperation...If we work together, a secure and sustainable water future can be ours” (Wolf, 2007, p. 241).

Although wars have not occurred over water, literature has shown a number of acute violence acts and uncomfortable political relations result from water tensions. Conflicts over shared water resources occur at multiple scales ranging from sets of

individual irrigators, to urban versus rural uses, to nations that straddle international waterways (Wolf, 2007, p. 245). But, literature has shown that international relations over freshwater resources were overwhelmingly more cooperative than conflictive (Eidem et al., 2012, p. 63; Yoffe et al., 2003, p. 1109). Flood management and development cooperation are found to be positive for cooperation among different nations.

Unlike events in other parts of the world, such as the Middle East, Europe, and North America, where there have been a number of studies and analyses, the events in Lancang-Mekong River Basin have been far less studied and analyzed. But the use of this basin is one of the most contested because these six governments have relatively fewer and more recent experiences in developing the basin where they used to confront against each other during a so-called cold war during the 1960s, 1970s, and 1980s.

Those riparian governments are pushing for their national development priorities while resource-dependent communities and international communities prefer the sustainability of the environment and ecology, including fish productivity and diversity of aquatic species. Leaders of the Lancang-Mekong River Basin have long been aware that their countries' destinies are entwined and will be shaped by the water events of the conflicts and cooperation they have created and will continue to create in the future. In this literature review, I will focus on five aspects of hydro-related development that are most important in the Lancang-Mekong River Basin: dam development, navigation and irrigation, drought and flood, fisheries, and the role of the Mekong River Commission/Committee (MRC) in facilitating coordination and management.

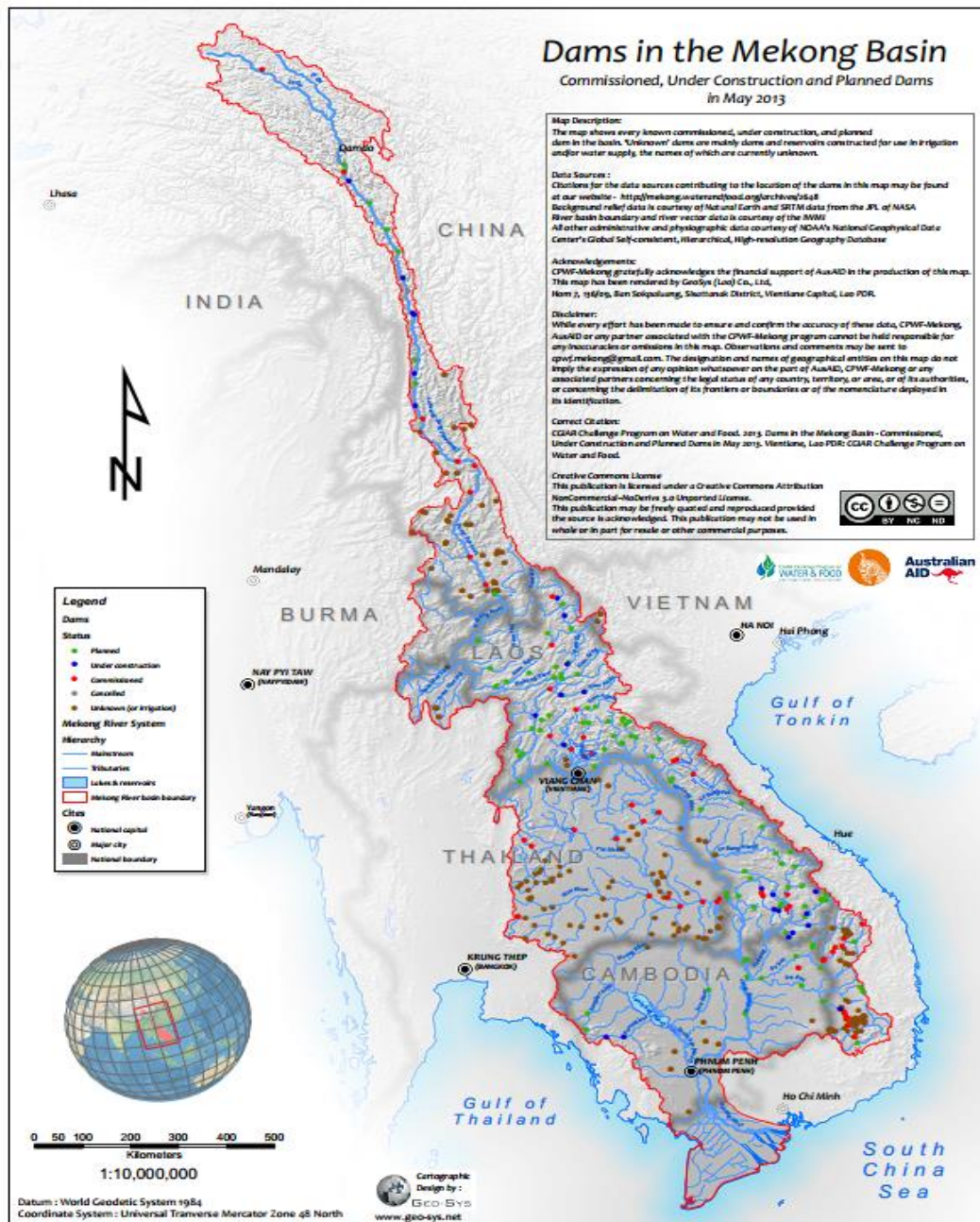
A. Dam Development

Since the countries in the region have been in periods of political stability and economic growth, they are consequently demanding more electricity, which is forecasted to increase between two and seven times the 2005 level by 2020 (MRC, 2010). Blessed with mountainous and steep valleys, Laos has planned to develop as many dams as possible in order to become a major power source or a battery of Southeast Asia and is willing to sell the electricity to China, Thailand, and Vietnam, whose private companies have constructed and planned to construct dozens of dams in Laos and many more in their own countries. “China, too, exports power to Thailand and Vietnam, and these exports are set to increase as development of the Yunnan cascade continues” (Pearse-Smith, 2012, p. 1154). Cambodia, with a lot of low and flat surface of the country, finds it relatively harder to build its own dams but really needs electricity supply from Laos, Thailand, and Vietnam.

Since these countries mutually benefit and depend on each other, it is bizarre for each of these nations to criticize the others in their dam development plans. For example, despite the severe impacts the Vietnamese Yali Falls has had on downstream Cambodian communities since 2001, the Cambodian government remains reluctant to make an issue out of Yali Falls with the Vietnamese government (Hirsch and Wyatt, 2004, p. 65). *Map 2*, from Challenge Program on Water and Food 2013 of the Consultative Group on International Agricultural Research (CGIAR), shows hundreds of dam and irrigation sites, which are planned, constructed, and operated. Currently, plans are underway for constructing 16 mainstream dams: four in China (in addition to other four being in operation), ten in Laos and Thailand, and two in Cambodia. Unlike others, Vietnam has

commissioned and planned the construction of more dams on Se San and Sre Pok rivers, which are the most important tributaries to the Lower Mekong River Basin.

Map 2: Dams in the Mekong Basin



Source: CGIAR Challenge Program on Water and Food. 2013. Dams in the Mekong Basin – Commissioned, Under Construction and Planned Dams in May 2013. Vientiane, Lao PDR: CGIAR Challenge Program on Water and Food.

Website: http://mekong.waterandfood.org/wp-content/uploads/Draft_A4.pdf

One of these planned projects is a 240 MW installed generating dam called '*Don Sahong*' with 30m to 32m height in the Hou Sahon Channel, which is located less than two kilometers north of the Laos-Cambodia border in the Khone Fall area of Khong District, Champasak Province, Southern edge of Laos (Baird, 2011, p. 211). Like all other dam development projects in its mainstream and tributaries, the *Don Sahong* is well known for an insufficient environmental impact assessment (EIA). Environmental watchdog WWF said that the EIA used for this controversial Don Sahong Dam in southern Laos was sloppy and based on assumptions without scientific methodologies (Hruby, 2014). The report did not include proper environmental studies, measures to mitigate impacts of migratory fish during the dry season, and international impact assessments of downstream nations, according to Te Navuth, secretary general of Cambodian national MRC (Barron, 2014).

Loss of fisheries in this Lancang-Mekong River basin because of Don Sahong Dam will negatively affect food security, nutrition intake, and the employment of millions of people, especially those in Laos, Thailand, and Cambodia. Accordingly, Laos and Cambodia will find it more difficult to achieve their poverty alleviation objectives and health-related United Nations Millennium Development Goals (Baird, 2011, p. 211). Moreover, it is observed that Thailand, Cambodia, and Vietnam express their concerns over dams differently. Thailand is generally more concerned with lower water in the basin, which makes it hard for this country to divert the water to supply its agricultural areas; Cambodia is worried about its richness of fisheries in Tonle Sap, which is the biggest fresh water lake in South East Asia and provides 16% of all Mekong fish; and Vietnam is annoyed by the fact that dams in China are responsible for increasing salinization of the Mekong delta, where more than 50% of rice is produced.

B. Navigation and Irrigation

Like the dam development, navigation and irrigation systems are other examples of hydro development in this international river basin. One giant navigation project was led by China, who initiated a plan for the cooperation called “Quadripartite Economic Cooperation (QEC)” with Laos, Burma, and Thailand in 1993. From February to May 1993, these four countries jointly surveyed the Lancang-Mekong basin in order to collect data for designing the navigation project, which required to clear rapids, shoals, and reefs in order to canalize the basin and allow ships to navigate freely from Simao (China) to Luang Prabang (Laos) (International Rivers Network, 2002, p. 1/2; Mirumachi and Nakayama, 2007, p. 413).

A year later, the QEC plan and its guideline for the navigation were formally finalized. The QEC was heralded as a major positive step towards more economic cooperation in the region, and it is considered to meet the Chinese strategic interest in the need to transit ships along the Mekong in Thailand from the Straits of Malacca in order to transport crude oil to China (Hensengerth, p. 331/2). The QEC cooperation was further strengthened by two other agreements: the 1998 Chinese and Laotian Agreement on Freight and Passenger Transport along the Lancang–Mekong River and the 2000 Chinese, Burmese, Laotian, and Thai Agreement on Commercial Navigation on Lancang-Mekong River.

Nevertheless, the fate of this project is unclear, with reports that the Chinese government abandoned it after the first of three phases (Onishi, 2011, p. 439). Beside this QEC project, there are other agreements among these countries in the region: the 1998 Cambodian and Vietnamese Agreement on Waterway Transportation; the 1999 Laotian, Thai, and Vietnamese Agreement for Facilitation of Cross border Transport of Goods and People, the 2000 Cambodian and Vietnamese Agreement between Cambodia and Vietnam

on the Transit of Goods, and the 2009 Cambodian and Vietnamese Agreement on Waterway Transportation (TFDD). This implies that those countries need the basin for water transportation.

Besides the navigation projects, China and Thailand are also primarily interested in irrigation. For example, blessed with higher elevation and upstream advantages, Thailand has planned and implemented irrigation projects in its arid northeast region in order to diversify economic development and prevent tragic flooding in Bangkok, which is just above sea level. Thailand is internationally recognized for its agricultural work and exports. Therefore, this riparian does not really pay much attention to strict policies covering dam construction in the whole basin and its tributaries, preferring instead a loose cooperation partnership, which allows Thailand, in return, to plan and implement its irrigation projects from the mainstream and other tributaries (Hensengerth, p. 328).

In fact, Thailand supports a few Chinese dams upstream because they can divert water released from the dam reservoirs for irrigation all year round without having to build dams by its own for electricity. And these dams provide protections against uncontrollable flooding in its capital. Even though details and impacts of the irrigation systems in both China and Thailand remain to be seen, their accumulative impacts, combined with those from dam development and navigation projects, will divert, on the one hand, large quantities of water from the Mekong Basin and, on the other hand, may devastate environmental and aquatic resources.

C. Drought and Flood

“Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer” (US EPA). Over recent decades, climate change in this international river basin is observed to include drought and flood, which affect all countries even though their severity and intensity may be different.

Drought is a condition of moisture deficit sufficient to have an adverse effect on vegetation, animals, aquatic resources, and humans over a sizeable area (USGS). Flood is “an overflow of water onto normally dry land. The inundation of a normally dry area caused by rising water in an existing waterway, such as a river, stream, or drainage ditch. Ponding of water at or near the point where the rain fell. Flooding is a longer term event than flash flooding: it may last days or weeks” (NWSWFO).

There are three types of drought: meteorological, hydrological, and agricultural drought (Joy, p. iii). Meteorological drought, which mostly occurs in in Khorat Plateau of Thailand and South-eastern Cambodia, happens when rainfalls over a regular period become significantly less than the overall long-term average. Hydrological drought occurs when water resources are significantly depleted because of the meteorological drought. Water levels in streams, rivers, and lakes are notably low. The agricultural drought, which is a combined consequence of the other two, occurs when both meteorological and

hydrological droughts retard productivities of the cross, livestock, and fisheries due to their failure to absorb and meet proper water requirements.

Drought in the Lancang-Mekong River Basin affects all countries and devastates fisheries and agricultural productions. For example, the most recent drought in 2010 caused dams in Southwestern China to dry, fishermen in Thailand to almost stop their fishery activities in fish-rich portions of the LMB, and almost half of the farmland in northern Vietnam to be under threat (Leitsinger, 2010). Although China is also a miserable victim of the drought, dams in Chinese Yunnan provinces are to be blamed by farmers, fishers, and officials of the LMB nations, especially in 2010. Scientific studies and evidences suggest that the drought was mostly the consequence of climate change, not the dams in China (Son, 2010; VOA News, 2010).

Table 1: Occurrence of the drought and flood and their impacts in Lower Mekong Basin

<i>Occurrence of Drought and Flood, Lower Mekong Basin</i>					
Disaster Details		Cambodia	Laos	Thailand	Vietnam
		1987-2007	1981-2008	1980-2008	1980-2008
No. of Disasters	Drought	5	4	6	5
	Flood	13	12	53	50
Probability of Occurrence	Drought	0.25	0.14	0.21	0.17
	Flood	0.65	0.44	1.89	1.78
<i>Average Impacts per Disaster, Lower Mekong Basin</i>					
No. People Affected (M)	Drought	1.31	0.19	3.92	1.22
	Flood	0.73	0.23	0.50	0.41
No. People killed	Drought	0	0	0	0
	Flood	87	6.4	44	84
Economic Cost (USD M)	Drought	27.6	0.25	70.7	129.8
	Flood	25.2	1.90	69.5	45.5

M = Million; Source: Joy, 2012, p. 3/4, 2010 (Adopted by author)

“Floods in the LMB are driven principally by rainfalls associated with two major weather phenomena: the widespread and extended rains of the Southwest monsoon, and

shorter, more localized rainfalls generated by the remnants of tropical weather systems moving westwards into the LMB after land-falling principally on the Northern and Central coasts of Vietnam” (Joy, p. 11). The *table 1* above shows how frequently both drought and flooding occurs and how seriously they impact LMB countries in from 1980s to 2007/8.

In this *Table 1* (from 1980 to 2008), Thailand and Vietnam experienced 53 and 50 incidents of the flood, faced possibility of 1.89 and 1.78 occurrences a year, and lost 69.5 and 45.5 million, respectively. But this disaster affected up to 0.73 million and killed 87 people in a disaster in Cambodia, while it affected 0.5 and .041 million and killed 44 and 84 people in Thailand and Vietnam, respectively.

However, the good news for the drought in the LMB is that none was reportedly dead in the four countries, according to the same table. The bad news for Cambodia is that flooding was expected once every four years, while it may take up to five or six years to have one in each of the other countries. Nevertheless, the cost to recover from the drought in Thailand (70.7 M) and Vietnam (129.8 M) was far more expensive than in Cambodia (27.6 M). For these two natural disasters, Laos is found to have the least impacts.

D. Fisheries

The Lancang-Mekong River basin is crucial in supporting the lives of at least 15 million in the UMB and another 61.2 million people in LMB by providing fish and fertile land for agriculture. Fish are important sources of protein intake for much of the population among low-income families and are crucial for maintaining good nutrition and health (Baird, 2011, p. 229). The number of fish species in the Lancang-Mekong River Basin is expected to be from 1,100 to 2,000, many of which migrate internationally. The largest fisheries are

found in Tonle Sap Great Lake of Cambodia, Kratie and Stung Treng provinces of Cambodia, the Mekong Delta of Vietnam, and the northern edge of the Thai-Laotian border.

Cambodia is the most productive freshwater fishery in the world with 230 kg a hectare a year because Tonle Sap provides 16% of the Mekong fish (Baran and Myschowoda, 2008, p. 55). Fisheries contribute 16% to Cambodian GDP (Zalinge et al., p. 336). With the richness of natural resources in the basin, 90% and 98% of Cambodian and Laotian populations, respectively, have become so much dependent on wild fish catch and agriculture, while 39% and 20% of Thai and Vietnamese population, respectively, depend on wild fish catch, aquaculture, and agriculture.

With market values from 1.7 to 2 billion, inland capture fisheries in the LMB are estimated to top 2.6 million tons, which is equivalent to seven times the inland fisheries' production in Northern America, 13 times the marine fisheries sector in Australia, or four times the whole fisheries sector in France (Zalinge et al., p. 336, Baran & Somountha).

Table 2: Annual Fish Catch and Consumption

Country	Annual Fish Catch (ton)	Annual Fish Consumption (kg/person)
China (Yunnan)	~ 25,000 (1%)	n/a
Laos	~ 180,000 (7%)	24
Cambodia	~ 680,000 (25%)	32
Thailand	~ 930,000 (35%)	25
Vietnam	~ 840,000 (32%)	34

Source: Baran & Somountha

Website: http://www.jsps.go.jp/english/e-astategy/date/07_asiahorcs_03_p1/keynote/keynote5_%20Baran.pdf

Here is the *Table 2* showing how many tons of fish are annually caught and consumed by a person a year among all riparian nations, except Burma and China. Thailand harvests the most with 35% while Vietnam and Cambodia follow with 32% and 25%,

respectively. However, in terms of consumption, the Vietnamese consumes up to 34 kg a year while Cambodia is in second place with 32 kg a year. But in terms of fish catch per person, Cambodia has the most productive worldwide (Baran et. al., p. 60).

Nevertheless, the industrial development of upstream dams, navigation, and irrigation is problematic as the rural economics of the downstream countries, Cambodia and Vietnam, are especially vulnerable to upstream changes (Baran et al., 2007, p. 6).

“Continued hydropower development will have a devastating impact on the livelihoods of millions of the basin’s inhabitants” (Pearse-Smith, 2012, p. 73).

E. The MRC and Development Cooperation

The history of this international river-based institute and development cooperation dates back to July 21st, 1954, when the Geneva Conference granted independence from France for each of Indochina countries: Laos, Cambodia, and Vietnam. The conference provided added interests of the United Nations Economic Commission for Asia and the Far East (ECAFE) in conducting researches and outlining the basin’s water resource development potential in its 1952 report (Radosevich).

At the same time, the United States feared that the presence of poverty in the region could attract these nations to join communism. Therefore, the United States Bureau of Reclamation decided to support these governments, doing research in 1955/6 and consistently confirming the 1952 report of the ECAFE. Subsequently, they supported the establishment of the 1957 international river-based institute, the “MRC”, in which all LMB nations were members.

The MRC, which was under the auspices of the United Nations, had a mandate to “promote, coordinate, supervise and control the planning and investigations of water resource development projects” (Radosevich). Despite rising disagreement about unanimity and unilaterality in their decision-making processes among the members, the MRC still ran from 1957 to 1978, when it became an Interim Mekong Committee because of the lack of full membership since Laos, Cambodia, Vietnam, and the United States had been involved in civil and regional wars from late 1970s to early late 1980s. Soon after the wars, Laos, Thailand, Cambodia, and Vietnam began to negotiate in early 1990s and re-establish the Mekong River Committee by calling it “Mekong River Commission” in 1995.

MRC members have been, in principle, more cooperative about a dozen of the programs including basin development; navigation; information and knowledge management; sustainable hydropower; integrated water resources management; fisheries, agriculture and irrigation; climate change and adaptation; flood management; and integrated capacity building (Sunchindah & Apichai, 2013, p. 3/4). In practice, each of these countries has its own interests, which may not be compatible with other those of countries’.

Discussions among these countries are to some extent confused and complicated. “A common approach toward planning the river’s future means accommodating Thailand’s lively and freewheeling society, the military dictatorship in Burma, the authoritarian democracy in Cambodia, and the Communist-ruled systems of Laos and Vietnam” (Fuller, 2010). “Perhaps most importantly though, the dominant motives of economic development and modernization held by each of the Mekong states render the economic benefits of hydro development too attractive, and the risk of getting offside with major trading partners too dangerous, to forcibly interfere” (Pearse-Smith, 157).

Until now, cumulative impacts of hydro power development, irrigation, navigation, and drought have always challenged the MRC's capacity to deal with the development in this region during recent decades, in spite of the fact that these countries are generally cooperative.

III. Research Objectives and Questions

There are three research objectives that aim to provide the most comprehensive analytical essay possible about events happening in the Mekong River from 1952 to 2010. Under these three objectives, there are six research questions for specifically exploring, explaining, and describing the events of this trans-boundary water. Below are the objectives and their related questions:

Research objective 1: To examine all 190 events of the Lancang-Mekong River in the database of the Trans-boundary Freshwater Dispute Database (TFDD), Oregon State University (OSU), and to explore whether these events are negative (conflictive), neutral, or positive (cooperative), using the Basins At Risk (BAR) Scale:

- Question 1a: How many events are there during the time period of the database (1952-2010)?
- Question 1b: How frequently are the events conflictive, neutral, or cooperative based on the 15-point BAR Scale?
- Question 1c: What are main summaries of each BAR Scale?

Research objective 2: To describe temporal trends of the events and identify outstanding factors that help explain conflictive and/or cooperative events:

- Question 2a: What are the temporal trends of the 190 conflictive, neutral, and cooperative events from 1952 to 2010?

- Question 2b: What are outstanding factors in the cooperative and/or conflictive events? In other words, what factors are associated with the cooperative and/or conflictive events?

Research objective 3: Based on findings of the trends observed above and in the literature, to provide policy recommendations to promote more peaceful, cooperative, and reliable relations among all the six governments:

- Question 3a: What policies should be recommended for Mekong riparian countries in order to reduce conflicts, on the one hand, and to promote cooperation for improving the livelihoods of the 76.2 million and protecting natural resources in the Lancang-Mekong River, on the other hand?

IV. Data and Methods

Data in this paper is from the TFDD, a project of OSU Department of Geosciences, which according to Wolf et al. (2003) is in collaboration with the Northwest Alliance for Computational Science and Engineering (Wolf et al., 2003, p. 32). This project is an informative, resourceful, and academic hub for initiating dialogues and filling in critical gaps in shared water governance among students, the public, officials, and for-profit and non-profit stakeholders. TFDD database consists of trans-boundary water events across the world.

The goal of creating this database is to identify all publicly reported instances of conflict or cooperation over international freshwater resources and to classify the events by the international river basin. All the event information collected and coded by the TFDD expert team is compiled in a relational database to allow for analyses at an array of spatial and temporal scales (Yoffe & Larson, 2001, p. 8). As a part of the whole events in the entire world, those used in this paper are from the Lancang-Mekong River.

Event data are generated by examining thousands of newspaper reports on the day to day interactions of nation-states and assigning each reported interaction a numerical score or a categorical code. ... When these reports are averaged over time, they provide a rough indication of the level of cooperation and conflict between two states (Schrodt 1993, p. 2; Yoffe & Larson, 2001, p. 10).

Water events are defined as:

Instances of conflict and cooperation that occur within an international river basin, involve the nations riparian to that basin, and concern freshwater as a scarce or consumable resource (e.g., water quantity, water quality) or as a quantity to be managed (e.g., flooding or flood control, water levels for navigational purposes) (Yoffe et al., 2003, p. 1110; Yoffe & Larson, 2001, p. 8/9).

Any water incidents or interactions that do not meet this analytical criteria are excluded from coding and classification (e.g., use of water as a weapon, victim, or target of warfare; navigation or construction of ports; boundary or territorial disputes such as control over river islands; purchasing and selling of hydroelectricity; involvement of a third party, that is, a nonbasin country; and issues internal to a country) (Yoffe et al., 2003, p. 1110; Yoffe & Larson, 2001, p. 8/9). In addition, the event is required to be at government levels within the Mekong River that is action-defined, recorded, and made available to the public (Eidem et al., 2012, p. 63).

Though there are a number of classifications, this paper will only explain these items: dates, basin code (Bcode), country list, number of countries, the Basin At Risk (BAR) Scale, event summaries, and sources. Date includes day, month, and years from 1952 to 2010; Bcode is MEKO, a short cut for Mekong (both LMB and UMB); the country list tells the names of the countries involved in the events; the number of the countries tells how many countries in each event; the BAR Scale is an international standard scale of 15 points from -7 to (+) 7 including "0"; the event summary is a very briefly condensed text describing each event; and the sources tells where the information is from.

The most important and highly standardized item, which basically covers this whole paper, is the 15-point BAR Scale, which was adopted from Professor Edward E. Azar's Conflict and Peace Data Bank (COPDAB), 1948–1978 (Wolf et al., 2003, p. 33). Both the COPDAB and the BAR Scale quantify and categorize the events in the region according to their levels of intensity of conflict or cooperation. This ranges from -7 (the most conflictive) to 7 (the most cooperative) while 0 (zero) is neutral. Here is the *Table 3: BAR Scale*

Description describing levels of the intensity:

Table 3: BAR Scale Description (Modified from Azar's COPDAB International Conflict and Cooperation Scale.)

BAR scale	COPDAB scale	BAR event description
-7	15	Formal declaration of war; extensive war acts causing deaths, dislocation or high strategic costs
-6	14	Extensive military acts
-5	13	Small scale military acts
-4	12	Political–military hostile actions
-3	11	Diplomatic–economic hostile actions
-2	10	Strong verbal expressions displaying hostility in interaction
-1	9	Mild verbal expressions displaying discord in interaction
0	8	Neutral or non-significant acts for the inter-nation situation
1	7	Minor official exchanges, talks or policy expressions—mild verbal support
2	6	Official verbal support of goals, values or regime
3	5	Cultural or scientific agreement or support (non-strategic)
4	4	Non-military economic, technological or industrial agreement
5	3	Military economic or strategic support
6	2	International freshwater treaty; major strategic alliance (regional or international)
7	1	Voluntary unification into one nation

Source: Wolf et al., 2003, p. 34; Yoffe et al., 2003, p. 112

In this paper, Microsoft Excel 2010 is used because of its relevance, clarity, and details needed for data presentation and analysis. This software program provides two graphs of the “Frequencies of Events” and “Temporal Trends of Events in the Lancang-Mekong River Basin”.

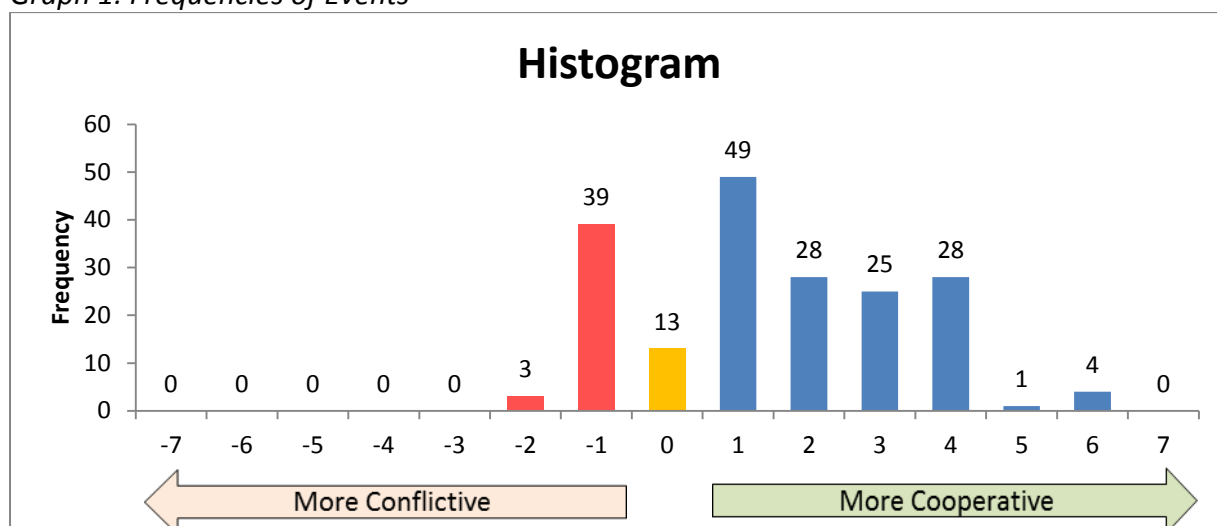
V. Results and Discussion

There are three parts in this “results and discussion” section. The first part, the classification of the Lancang-Mekong River Basin Events, provides a graph illustrating the frequencies of each level of the conflicts and cooperation and answers all questions in Objective 1. The second part, temporal trends and outstanding factors, provides another graph showing chronological events from 1952 to 2010. This part offers answers to all questions in Objective 2. Outstanding factors identified in this second part are the same as those factors in the first part, but they are not explicitly highlighted in the first one. The third part, outstanding factors and policy implications, describes how those factors are found in and associated with conflictive and/or cooperative events. It also details relations between these factors and policy recommendations. Thus, it provides an explanation to Objective 3.

1. Classification of Lancang-Mekong Basin Events

From 1952 to 2010, there are 190 events in the Lancang-Mekong River, distributed in nine groups of the BAR Scale: -2, -1, 0, 1, 2, 3, 4, 5, and 6 in *Graph 1: Frequencies of Events*. There is no extreme -7 and 7, which means that there are not two or more countries going to war because of the trans-boundary water in this basin and neither do two or more countries unite to become one country. There are also no events in -6, -5, -4, and -3 BAR Scales, which are all conflictive. All in all, there are 42 conflictive events in -2 and -1 BAR Scale while there are up to 135 cooperative events, and there are thirteen neutral events. This means that the international river basin has been a more cooperative factor for these six countries in the region than a conflictive one.

Graph 1: Frequencies of Events



There are three events in the “- 2” BAR Scale. The first event started in 1992, when Thailand cancelled the Mekong Committee Plenary meeting and asked the United Nations Development Program (UNDP) to remove its executive agent from the committee, and hence the UNDP complied. Another event was related to insufficient resource management in the MRC and unsatisfactory transparency in the Laotian dam proposal in 2007. The last event in this category is that Thai water resource officials argued in 2010 that the drought in the Mekong River was directly linked to dams in China, but the Chinese representatives have always rejected the claims.

There are 39 events in the “-1” BAR Scale. These events are relatively very recent as mostly they are from the year 2000+; for example, there are 12, out of all the 13, events in 2010 alone. The number of conflictive events in this category is more than any single positive BAR Scale, except the “1” BAR Scale, which comprises of 49 events.

The events can be summarized into three main groups – termination of a contract to buy electricity from Lao, criticism over dam development in China, and environmental concerns over dam (proposed) development and navigation projects. Termination of the

contract to buy power from Nam Theun 2 Dam was made by Thailand in 1996, which makes it the first event in the “-1” BAR Scale, even though Laos urged Thailand not to do so. Laos argued that such a decision would discourage foreign investors from participating in an ongoing bilateral power investment.

Criticism over dam development in China was led by the Thai government and Thailand-based nonprofit organizations since they have experienced droughts and lower water levels, which negatively affect their irrigation and agricultural production. For example, Rivers Watch East and Southeast Asia, Chiang Mai-based environmental groups, Thai business leaders, and Save the Mekong argued in 2004 that the Manwan and the Dachaoshan dams, built by China, were supposed to be responsible for lower water levels in the Mekong River. However, the Chinese government has always refuted the claims throughout the period.

The last main events in this category are environmental concerns over dam proposed developments in LMB, UMB, and Salween River. These concerns have been raised vigorously by Thai and Cambodian civil society organizations and local communities whose livelihoods depend on this trans-boundary water. In addition, Cambodia and other environmental groups raised concerns over joint projects in blasting rapids in the Lancang-Mekong River to improve the channel for transportation from Thailand, Laos, Burma, and China in 2002. This project at its later stage faces difficulties in navigation due to droughts and the overall lower water level in the Mekong River. Furthermore, the International River Network criticized the Asian Development Bank (ADB) over its financial loan for power -transferring cables, which would displace thousands of people in Laos, Thailand, and Vietnam.

There are thirteen events in the “0” BAR Scale. These 13 events in this category are three times less frequent than the “-1” and about four times less frequent than “1” BAR Scales, but these events are three times more frequent than “6” BAR Scale. The first event was when the Laotian government proposed to have a dam neutral zone in the Mekong River, and other events throughout the period are either neutral or non-significant about particular countries or institutes. For example, in the mid-1990s, all riparian countries in the Lower Mekong Basin urged China and Burma for more participation and cooperation.

Even though these UMB countries participated to create a number of events with the LMB countries, they stressed their intention of not becoming MRC members since they were concerned over losing some water rights over the river under their own territorial sovereignties. Furthermore, Cambodia asked the Laotian Dam Sekong project to be more transparent as it may seriously impact Cambodian fisheries. During this period, both the MRC and China responded to a number of allegations that the low water level in the Mekong River resulted from overall droughts and low precipitation, not dam development in the UMB. Accordingly, in 2010 the Chinese embassy in Bangkok, Thailand, said that the Chinese dams were not responsible for the low water levels.

The “1” BAR Scale is a unique category, in which there are 49 events. This number is the highest in this database and is 49 times more frequent than the events in the “5” BAR Scale and twelve more times more frequent in the “6” BAR Scale. These events are mostly in 1995, 1996, and 2000+. Three main themes of the events are: cooperation among countries, workshops/meetings, and denials of impacts from the Chinese dam developments.

First, it started in 1968 when Laos and Thailand met and discussed possibilities of having dams in the Mekong River, and this event led to a number of other events at later

stages, where Thailand planned to purchase electricity from Laos. At the same time, it is seen that Vietnam has been trying to work more closely with both Cambodia and the MRC while Burma & China have both expressed their interest to participate in the MRC. But they fall short of becoming members.

Second, there are a number of meetings, workshops, and forums, mostly after 1990, to discuss flood management, re-establishments of the MRC, and sustainable development (fisheries, irrigation, agriculture, agroforestry and challenges). Among all, representatives from the MRC members attended the MRC's joint committee meeting in 2001 to discuss the joint management of Mekong river affairs focusing on trans-boundary issues of the river basin planning and management, as well as reviewing progress of the MRC.

Third, China has denied the impacts from its dams on the lower water level all times during this study period. An MRC official stated in 2004 that the Mekong's low flows were unrelated to Chinese dams and their operation. Furthermore, in 2010, the Chinese invited Mekong region countries to visit the Jinghong dam on the UMB, superficially as a way to demonstrate good intentions and that China's water management regime is not the cause of low water levels downstream. Consequently, Ministers of the Ministry of Environment in the Greater Mekong Subregion deny that China's dams on the upper reaches of the Mekong are the cause of the river drying up. Cambodian Prime Minister Hun Sen said in 2010 that blames on China over the droughts of the Mekong River were baseless and the global climate change was to be blamed.

The "2" BAR Scale is relatively more official and formal than the "1" BAR Scale as it comprises of events that are more official verbal support. In the "2" BAR Scale, there are 28 events, which are about ten and twenty events less than the "-1" and "1" BAR Scale events,

respectively, but the nature of the events in this category is almost the same as those in the “3” and “4” BAR Scales, all of which are directly related to the “1” BAR Scale events – Chinese dams and cooperation among countries. For example, in the mid-1950s, the United States Bureau of Reclamation urged for more joint management plans for developing the Mekong River.

The LMB governments welcome the initiatives, and accordingly they called for foreign investors, including funders such as the World Bank, ADB, and Korean businessmen for hosting training programs and doing feasibility studies, particularly relating to hydropower dams. Two main events between Laos and Thailand in this scale are sale offers for both hydroelectricity and water from the former to the latter. In addition, Cambodia regained its membership in the MRC in 1991 after some 30 years of its absence due to internal civil and regional wars. Regarding Chinese dams, both Thai and Cambodian Prime Ministers share similar thoughts even though Abhisit Vejjajiva expressed faith in China’s water management policies and argued that it is too early to conclude that China’s dams are causing the droughts while Hun Sen does not expect that the dams in China harm downstream countries, and he has generally expressed satisfactions with the Chinese efforts to improve environmental quality and people’s lives.

The “3” BAR Scale is more tangible and visible than the “2” BAR Scale as it requires written documents. In the “3” BAR Scale, there are 25 events, which are mostly spread throughout the period, and the first event in this category is in 1952, which is the first event for the whole study timeframe. That event was when the ECAFE, with cooperation of four other lower riparian countries, conducted the study and found that hydroelectricity and irrigation development are possible for the Mekong River.

This finding may have helped the MRC to receive the first donation from France of about 120,000 USD in 1957, right after the MRC was established. In this BAR Scale, Thailand and two other countries (China and Laos) have had electricity deals, in which Thailand agrees to buy the power from the Jinghong dam of Lancang River as well as the Nam Ngum dam of one of the most important tributaries of the Mekong River. Similarly, China agreed to provide information at least from these two dams – the Jinghong and the Manwa – about their water level, flow, and rainfall to other countries in this region. Another main area for cooperation in this category is development cooperation in the areas of energy, drought, and water efficiency among these riparians, who are also in favor of supporting navigation projects from the Simao port in Yunnan province of China to the Louang Phrabang port of Laos.

In the “4” BAR Scale, there are 28 events, about half of which happened from the early 1990s to the early 2000s. The “4” BAR Scale is relating to more official written documents such as agreements. One of the obvious examples in this category is the charter for establishing the “Committee for Coordination of Investigations of the Lower Mekong”, which later brought into existence the Mekong Committee in 1957 among Thailand, Laos, Cambodia, and Vietnam.

There are dozens of other officially written documents and memorandums of understandings among these riparians in the areas of water management, irrigation cooperation, environmental frameworks, etc. which are all considered to be development cooperation. Laos and Vietnam have, for instance, signed an agreement for irrigation cooperation, and at the same time Laos signed an electricity cooperation with both Vietnam and Thailand.

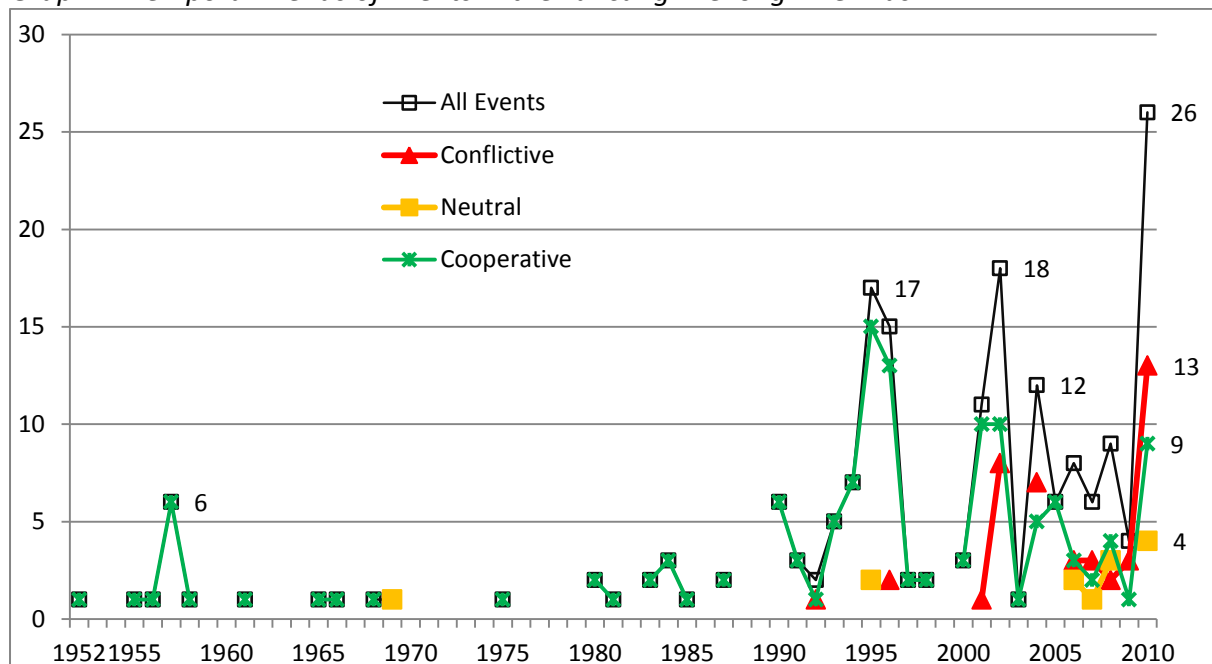
A few feasibility studies for hydropower dam developments have been conducted in Houai Sai (Yunnan province, China), Nam Ngum (Laos), Bolikhamsai Province (Laos), and O Chum hydroelectric project (Ratanakiri, Cambodia). Moreover, advanced technologies for observing irrigation, fisheries, management of drainage basins, and hydroelectricity have been introduced and categorized into this BAR Scale. These technologies and the willingness to cooperate among these governments aim to alleviate poverty, improve the environment, and sustain aquatic resources in the Lancang and Mekong Rivers.

The “5” BAR Scale has the least number of events among all nine relevant BAR Scales in this study because it has only one event, which is three and four times less than “-2” and “6” BAR Scales events, respectively. Moreover, it is 49 times less than “1” BAR Scale events. That one event happened in 1966, when New Zealand financially supported Greenland (Denmark) to help develop the LMB. The reason for having the least number of events in this category is probably because this scale requires more comprehensive and cohesive support from one to another stakeholder as the “5” BAR Scale is defined as *“Military economic or strategic support.”*

The “6” BAR Scale is the most cooperative among all the nine-group BAR scales. There are four events in the “6” BAR Scale. The first event happened in 1957, when four LMB governments signed a statute of the MRC. The second event was about ten years later, when the Thai government signed a convention to buy hydropower from the Laotian government. The third and fourth events are agreements among governments in the LMB on sustainable development cooperation and water use monitoring in 1995 and 2006, respectively.

2. Temporal Trends and Outstanding Factors

Graph 2: Temporal Trends of Events in the Lancang-Mekong River Basin



There are three very interesting points in *Graph 2: Trends of events in the Lancang-Mekong River*. First, similarly to the bar graph above, more cooperative events (in green) outnumber both neutral (yellow) and conflictive (red) events. This means that these riparian governments are more willing to work together for mutual benefits. Second, there are fewer events recorded at the beginning and middle periods in this timeframe, particularly from 1952 to 1989, due to less availability of events, most probably because of events in local languages, contextual politics, and/or less incidents of events in this region, where civil and regional wars were common in the 1960s, 1970s, and 1980s. Cambodia, for example, had been embroiled in civil wars and regional wars more than 30 years before the Paris Peace Agreement in 1991.

Third, it is intriguing to know what outstanding factors contribute to cooperative and/or conflictive events. In the other words, it is interesting to know what factors are

associated with conflictive and/or cooperative events. Even though it is not good news to hear, it is an undeniable fact of having more conflictive events (13) than cooperative ones (9) in 2010, the most recent year in this study period. Nevertheless, those events in 2010 reflect the reality in the region as those countries, especially China and Laos, are more likely to push forward for their hydropower development systems in order to promote their local and national economic growth in response to demands from rising populations in their countries and their neighbors.

Here are descriptions of major events in 1957, 1995, 2002, and 2010 and those relevant factors. Six events in 1957 are the highest incidents happening in a single year from 1952 to 1989, most probably because it was when the MRC was established. These events range from “2” to “6” BAR Scale, which are all cooperative among LMB governments. With overall political, environmental, and economic interests in the region, France, the United States, and the ECAFE had technically and financially contributed to data gathering and analysis in 1952 and 1954/5/7, which found that the Mekong River had potential for hydro development, and these international communities called for development cooperation in the basin. Accordingly, Laos, Cambodia, Thailand, and Vietnam, signed a statute to bring into existence the MRC in 1957. Therefore, three outstanding factors in the cooperative events in 1957 are: dam development, development cooperation, and the MRC. They are found in all the events and other proceeding events in the following years to be cooperative.

Seventeen events in the year 1995 is the third highest number of events recorded during this study period. Overall events in this year are about recommitment and the willingness to work together more cooperatively among LMB governments after many years of distrust and regional wars. This rise in the events, if compared to years earlier in the

graph, results from the reestablishment of the MRC and the expressions of interest from both Burma and China to participate in MRC events.

Thailand and China's Yunnan Province called for international investors to jointly develop large-scale hydropower plants in China, and they were confident that constructing dams in the Lancang mainstream would help alleviate flooding in Thailand and Laos. There were a number of agreements, projects, and electricity cooperation among all these countries, except Burma and Cambodia. For example, Laos, Thailand, and Vietnam signed a memorandum of understanding on electricity cooperation. Throughout 1995 and the following years, the MRC discussed basin development plans in which there were up to 78 projects in all basin-wide, country-wide, and province/state-wide levels.

Accordingly, three outstanding factors, among all the seventeen events are: an expression of interest from both Burma and China to cooperate with the MRC, the development cooperation, and the MRC. They are the factors for cooperation.

Eighteen events in 2002, just one event more than those in 1995, make this year the second highest in the study. Unlike those events in the third highest year, seven events in 2002 are negative in the "-1" BAR Scale. The most problematic issue in these conflictive events is an environmental concern, mostly expressed by local communities and environmental groups in Cambodia, Laos, and Thailand, over China's dam construction projects on the mainstream Lancang river in the Yunnan province and China's projects to clear rapids and shoals from the Lancang-Mekong River in order to improve navigation all the way from China down to Laos.

However, it is worth noting that the governments of these riparian countries, most probably except Cambodia, have supported this water navigation project. Two outstanding

factors found in the conflictive events in 2002 are: dam development and navigation projects while four others in the cooperative events are: navigation projects, development cooperation (relating to fisheries, irrigation, energy, agriculture, agroforestry, and inter-sectorial competition), information sharing, and flood management. Among these factors, the dam development and the navigation projects are the most ambiguous because they depend on which level and what time they are referring to.

For example, the government of these countries (China, Thailand, and Laos) need energy for city populations and economic growth, so they support each other in conducting surveys and constructing a few dams in China as a way to prevent tragic flooding, but when these dams and other Chinese dams are thought to negatively affect fish, water flow, the environment, and livelihoods of the people in this basin the farmers, fishermen, environmental groups of these countries and even the governments start criticizing the dam development. Additionally, from the very beginning, environmental groups in LMB did not support the navigation project because of forecasted dangerous environmental concerns.

The final year in this study is 2010, which is the most exceptional year because there are up to 26 individual events, more than any other single year. Unlike events in the past (except the events in 2004), there are more conflictive events in this year than the cooperative ones. Thirteen events are conflictive in both “-2” and “-1” BAR Scales while there are only nine cooperative and four neutral events. Two outstanding factors for these negative BAR Scales are: dam development (as mentioned in 1957 and 2010) and drought.

Dam construction in China seems to be one of the outstanding factors throughout the period in this region and presumably leads to a number of negative repercussions such as water shortages and concerns over environment and livelihoods. But what makes the

events cooperative in 2010 are: development cooperation in the region, statements linking droughts to climate change, and statements by the Chinese and the MRC to declare that droughts and shallowness of water in the region are mainly due to high temperature and less precipitation, not because of the Chinese dams.

3. Outstanding Factors and Policy Implications

From *Graph 2*, it can be concluded that *three* outstanding factors that are associated with conflicts in the Lancang-Mekong River are: dam development, navigation project, and drought. At the same time, *five* main factors that are associated with cooperation are: dam development, navigation project, flood management, development cooperation, and the MRC. This section will discuss each of these factors in turn, and provide policy recommendations.

A. Dam Development

As a part of hydro development, the dam development dates back to the earliest preparation for cooperation among LMB countries. During the 1950s, there were strong motivations for hydroelectricity and irrigation development in the basin, where technical and financial support came from France, the United States, and ECAFE. However, the dam development has been one of the outstanding factors found in both cooperation and conflicts in this basin.

Dam development: a factor for cooperation

The Laotian government met a few times with Thai and South-Vietnamese representatives to discuss dam openings and a dam neutral zone in the Mekong River in 1968. Later, it was quiet from late 1960s to early 1990s because of regional and civil wars engulfing Burma, Cambodia, Laos, North Vietnam, and South Vietnam. Feasibility studies, construction, and the operation of the dams were mostly in the 1990s until the present. Thailand was observed to be active in contacting both China and Laos in proposing joint venture projects for dam-related investments. They called for international investors, agreed on hydropower purchasing deals, and discussed how dams in China could eventually help mitigate disastrous floods in both Laos and Thailand.

In 2001, China even asked Laos to contribute to construction costs of the Xiaowan dam in the Yunnan Province of China, which could help relieve annual floods that devastated Laos. Furthermore, Thailand and Laos agreed on construction of three dams on Mekong tributaries to retain enough water for use for both sides all year in 2008 as a part of drought management strategies. There were at least three agreements signed:

- Laotian company, Thai company, and foreign investors: A Memorandum of understanding on Nam Theun 1-2 hydropower project (1993),
- Laotian and Thai companies: A Memorandum of understanding on developing Nam Ngum-3 hydropower project (1994), and
- Cambodia, Laos, Thailand, and Vietnam: A memorandum of understanding on electricity (2001).

Dam development: a factor for conflicts

Since there is more potential for deals with China to build dams for energy and flood prevention, Thailand has decided to terminate a power-purchasing contract to buy power from the Nam Theun 2 Dam of Laos, but Laos said that such a decision would drive away foreign investors from participating in hydropower investment. Moreover, China seems to be against all other countries in the region regarding their ambitious energy plan including at least eight (proposed) dam developments in the Lancang River.

It is clear that two Chinese dams in operation – Manwan and Dachaoshan – have some impacts on downstream riparian nations regarding water flow, water level, and fish migration. But eight upcoming dams in the mainstream Lancang River will definitely make the environment and aquatic resources even more vulnerable, especially adding problems to existing ones from drought, flood, lowered fish productivity, and poorly functioning ecological systems.

As a result, many local, regional, and international advocacy groups such as the International River Network, Rivers Watch East and South, and Towards Ecological Recovery and Regional Alliances (TERRA) have tied environmental problems to Chinese dams. For instance, Chiang Mai-based environmental groups blamed Chinese dams for dramatic decreases in the Mekong water level in 2004. Social and environmental groups (200+) complained that the MRC's environmental impact assessment of eight proposed dams on the main stream were insufficient in 2007. Many scientists warned of negative impacts of the dams on the Mekong to the environment and livelihoods, namely through the potential harm to fish catches in 2010.

Policy Recommendation 1: Dam Development

It is clear from the literature review and the events of the TFDD database that all six riparian countries need electricity from dam development in the Lancang-Mekong River. The dam development will provide its owners far cheaper electricity, which will have more comparative economic advantages for investment in the region. Additionally, the electricity can be sold to neighboring countries. For example, both China and Laos are selling their electricity to Thailand and Vietnam, who continue to resell it to Cambodia.

However, given the fact that there are more conflictive events than cooperative ones in recent years and in order to avoid political tension and physical violence in the region, these countries need to believe that the cooperation among all governments is a necessary part of the agenda. Thus, they need to plan and construct their dams transparently, accountably, and openly for supplying electricity, conserving the aquatic resources, and promoting the livelihoods of the people.

B. Navigation Projects

Water is traditionally used for navigation: trade and communication. Navigation in this international basin is not a new story because Thailand (formerly known as Siam) and France (representing Indochina: Laos, Cambodia, and Vietnam during the colonization from 1963 to 1954) signed the 1926 convention on regulation and relations between the two territories. Until now, there are at least four international navigation projects, but not all projects have been so cooperative. Thus, the navigation project, like the dam development, is one of the factors associated with both cooperative and conflictive events.

Navigation project: a factor for cooperation

“On the basis of equality of right, freedom of navigation shall be accorded throughout the mainstream of the Mekong River without regard to the territorial boundaries, for transportation and communication to promote regional cooperation and to satisfactorily implement projects under this Agreement. The Mekong River shall be kept free from obstructions, measures, conduct and actions that might directly or indirectly impair navigability, interfere with this right or permanently make it more difficult.....”

– Article 9 “Freedom of Navigation” of MRC’s 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin.

This article reflects the interests among Laos, Thailand, Cambodia, and Vietnam in promoting the ‘freedom of navigation’ throughout the Mekong River mainstream. There should be no obstruction, measures, conducts, and actions that might limit this movement.

In addition, there are more regional agreements as the following:

1. China and Laos: Agreement on Freight and Passenger Transport along the Lancang–Mekong River, adopted in November 1994,
2. Cambodian and Vietnam: Agreement on Waterway Transportation, 13 December 1998,
3. Laos, Thailand, and Vietnam: Agreement for Facilitation of Cross border Transport of Goods and People, signed in Vientiane, 26 November 1999,

4. Thailand, China, Burma, and Lao: Agreement on Commercial Navigation on Lancang-Mekong River, signed at Tachileik on 20 April 2000,
5. Cambodian and Vietnam: Agreement between Cambodia and Vietnam on the Transit of Goods, 7 September 2000, and
6. Cambodia and Vietnam: Agreement on Waterway Transportation, signed at Phnom Penh, 17 December 2009.

With the documents above, the ESCAP and the MRC initiated a project on navigation systems in 1996 to support these riparian countries in formulating and implementing harmonized aids joint plans to ensure safe navigation for passengers, properties and the environment. This project was welcomed by all regional governments and generously financed by the Governments of Finland and the Netherlands in 1999 and 2000, respectively (ESCAP & MRC, 2002, p. 2).

Navigation project: a factor for conflicts

With the interest of transporting goods within the region and crude oil through Thailand, China planned to spend more than \$5 million in 2003 to dredge and blast rapids and shoals in a number of sections of the Mekong River as part of a larger project from China to Laos in order to improve Mekong navigability. But later that year, Cambodia and Laos expressed strong concerns over Chinese navigation cooperation plans and called for an international environmental impact assessment.

The concerns over the navigation project are echoed by environmental groups, advocates, and activists, especially when the impacts are combined with those of regional

drought and the Chinese dams. For example, Pianporn Deetes, a Thai campaigner for the environmental group International River, said that it was where people fished, where people got food to feed our families, but now the richness has gone; therefore, she blamed both Chinese dam and navigation projects (Fuller, 2010).

Policy Recommendation 2: Navigation Projects

As presented in the literature review and events from the TFDD, there are different navigation projects: the LMB navigation projects and a UMB-LMB project. A similarity among these projects is that they cross borderlines from one country to another. However, unlike the LMB navigation projects, the UMB-LMB project has reportedly caused numerous concerns for the environment, aquatic resources, and livelihoods of the people.

Regardless of what the projects is, both the LMB and UMB governments need to deal with three issues: dams, droughts, and the environment. Therefore, in order to promote navigation projects effectively and efficiently, concerned riparian countries, especially China and Laos, need to free the Lancang-Mekong River Basin from dam construction. The dams should not be built on other main tributaries necessary for navigation activities. Furthermore, the navigation projects' impacts on the environment and drought need to be thoroughly and transparently studied, analyzed, and implemented for the benefits of the basin.

C. Drought

Two main natural disasters found in the TFDD database are drought and flood. Compared with floods, droughts are less likely to happen. Besides human death, each

incident of drought is more tragic than each incident of the flood shown in *Table 1* on page 20. In general, the drought is a factor for conflictive events, but drought management, like flood management, is considered to be a factor for cooperation. Unfortunately, there is little information on the drought management found in the events (TFDD). In other word, the drought management is not standing out enough. Therefore, the drought here is considered to be one of the outstanding factors for the conflicts.

Photo: A Cambodian worker transporting sand along the Mekong River



Photo by Tang Chhin Sothy, Agence France-Presse;

Website: http://www.nytimes.com/2010/04/02/world/asia/02drought.html?_r=1&

“The Mekong is really drying, at some point people seem to be able to even walk across the river, which has never happened before,” said Srisuwan Kuankajorn, co-director of TERRA (Leitsinger, 2010). The drought in 2010 across Southern China (Yunna, Guizhou, and Sichuan provinces) and Southeast Asia (Thailand, Cambodia, and Vietnam) hit its lowest level in 50 years, affecting about 20 million people, 6.5 million hectares of farm land, and

millions of livestock, generating losses in billions of dollars in the whole Lancang-Mekong basin.

Thailand is most probably the best recorder, among all riparian nations, of the events involving the drought. According to Thailand's Department of Disaster Prevention and Mitigation, at least 7.6 million people in 59 of the country's 76 provinces were affected by drought (Marks, 2011, p. 230).

According to the events from the TFDD, the Chinese dams and navigation projects were considered as culprits in causing the basin to dry up. In 2010, Thai water resources officials, farmers, and fishermen claimed that the drought was directly linked to Chinese dams and their operation, but the Chinese representative denied the claims. A Thai Senator suggested in 2010 that the Thai government should negotiate with the Chinese government for increasing water discharge on the Mekong in order to alleviate drought, while the "Save the Mekong group" issued a statement criticizing the MRC's inability to forecast the drought and allowing the exoneration of Chinese dams.

Policy Recommendation 3: Drought

The drought issue in the Lancang-Mekong River may represent the best example of lacking scientific and sufficient information, especially the information from the dam constructions and operation in China. Water shortages in the Lancang-Mekong mainstream seem to directly link to the Chinese dams because all these dam operations on the mainstream now are owned by the Chinese, but those supporters of this argument may fail to fully understand the cumulative impacts from the dam construction and operation in the main tributaries of the basin in Laos, Thailand, and Vietnam.

Accordingly, more effort and attention should be placed on determining why there is drought in the region. Dam development, irrigation, and climate change (low rainfall and precipitation), possibly among other things, are responsible for the drought. Each of these factors may dry out the basin. Thus, more research, transparency, and cooperation should be conducted. The transparency, for instance, is necessary because suspicion over the drought associated with the Chinese dams would not have arisen had China been more transparent about its hydrological data in the first place (Parameswaran, 2010, p. 5).

D. Flood Management

Similar to the drought, flooding is also a part of climate change, and can happen anywhere in Lancang-Mekong basin. Unlike the drought, which was not linked to any deaths, flooding can cause hundreds of deaths in the Lancang-Mekong River. “[T]he greatest flood risk in Cambodia and Vietnam is mainstream flooding (a very high risk), whereas in Lao PDR it is tributary flooding (a high risk), and in Thailand it is inferred that mainstream and tributary floods have about the same risk (medium)” (Joy, 2010, p. ii). Thus, flooding alone is a factor for conflict, but it appears less frequently than flood management in the TFDD database. Therefore, an analysis here focuses on the flood management as the factor for cooperation.

The first event of the flood management was in 1995 when a Thai expert said that the construction of new dams in China would help prevent catastrophic flooding in Thailand. Six years later, China asked Laos to financially contribute to construction costs of the Xiaowan dam in the Chinese Yunnan province as it could help mitigate flooding with the

capacity to devastate Laos. From 2001 to 2008, there were a number of agreements and discussions on how to tackle flooding.

Moreover, in 2001, the UMB and LMB governments adopted a new 10 year strategy for cooperation on projects including flood control, water management, and a strategic environmental framework. In 2002, the first annual Mekong Flood Forum was hosted by the MRC members to discuss flood management and its mitigation. In the same year, the USAID office of US Foreign Disaster Assistance contributed \$25 million to help these six riparian governments in a new Flood Management Program. And "we need to create a highly efficient flood forecasting system," said Olivier Cogels, MRC CEO, at annual Mekong Flood Forum (TFDD).

Policy Recommendation 4: Flood Management

Cooperation to overcome flood disasters is very well noted throughout the region, indicating that flood management is one of the best cooperative examples among the six countries. However, the deaths and other casualties are still reported whenever this tragedy occurs. Therefore, all six countries need to review all agreements, 10-year strategies, and other documents/forums in order to find more reliable responses and strategies.

Furthermore, these countries, especially Cambodia, will need to learn from the other in order to accurately predict flooding, quickly spread news, and help the affected people by relocating them before and during flooding, saving lives by meeting immediate human needs, and supporting flooded victims in restarting their lives again.

E. Development Cooperation

Development cooperation is generally very broad, most probably because all six governments want to use this concept when they are referring to dam development, navigation, flood management, irrigation, agriculture, tourism, agroforestry, fisheries, environment, livelihoods, etc. However, dam development, navigation, and flood management are specifically discussed in separate sections because they independently explain so many events in the basin.

History of the development cooperation started in the early 1950s when ECAFE and the US Bureau of Reclamation Report discovered that the Mekong River basin had potential for hydroelectricity and irrigation system development and called for more regional cooperation and development. To promote this initiative, New Zealand and Denmark supported the initiative. There are a number of other written memorandums and agreement among all countries, except Burma/Myanmar, such as:

1. Laos and Vietnam: Treaty of Friendship and Cooperation in, 1977,
2. Cambodia and Vietnam: Agreement in Cooperation and Aid in Water Conservancy, 1984,
3. Laos and Thailand (MDX Power Company Ltd): A contract for a feasibility study on the development of the Nam Ngum-3 hydropower project, 1987,
4. Cambodia, Lao, Thailand, and Vietnam: The Agreement on Cooperation & Development of the Mekong River, 1993,
5. China and Laos: Cooperation Memorandum for Surveying a Small Hydroelectric Generation Project in Houai Sai, 1993,

6. Cambodia, Laos, Thailand, and Vietnam: Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, 1995, and
7. Laos, Thailand, and Vietnam: A memorandum of understanding on electricity, 1996.

With these documents, Vietnam was observed to provide many technical supports to both Laos and Cambodia, while these two countries had had a number of active roles in the region. For example, Laotian and Thai officials worked on the feasibility and design of development projects including irrigation, dam construction, and water sharing between the two countries during the 1980s.

The Cambodian Foreign Minister requested that the Asian Development Bank (ADB) assist the six nations of the Mekong River Basin in developing this international river basin. In 2002, this Cambodian minister proposed the ADB to conduct feasibility studies of hydropower development for electricity price reduction while the development would also help improve industrial and agricultural development.

Policy Recommendation 5: Development Cooperation

The “development cooperation” is probably the most important factor for cooperation among LMB and LMB-UMB countries. Many agreements, memoranda, and meetings were made possible in order to socially, economically, and culturally benefit each country in region. These are very positive documents for cooperation and progressive steps to making the basin known as ‘one institute’. However, the only problem for this development cooperation is the failure to have China and Burma as members of the MRC.

The development cooperation requires honest, mutual, and transparent relations and management. But this is not the case since non-members, China and Burma, may do whatever they want at the expense of other countries in the same trans-boundary basin. Negative impacts upstream in China and Burma from other water-related projects will sooner or later impact the downstream river.

F. Mekong River Commission/Committee (MRC)

The existence of this institution has led to a rapid increase in the numbers of events in 1957 and 1995 and to potentially increasing mutual trust and cooperation (TFDD). Three roles that this institution plays are those of representation, expertise, and forum. First, this institute is *an official representation* of four LMB governments. Throughout the early and most recent histories of this institution, there has been cooperation between the MRC and others such as Burma, Canada, China, France, Netherland, New Zealand, Sweden, USA, USAID, ADB, World Bank, and other nations and multilateral organizations. For example, with an official request from the MRC, China agreed to share water level data between June 15 and October 15 since 2002.

Second, the MRC is *a group of experts* with latest technologies and technical support from advanced countries such as Canada and the USA. In 2002, the Canadian Space Agency and the Canada Centre for Remote Sensing provided the MRC with access to advanced technologies and products for earth observation and geometrics to monitor a variety of areas, including irrigation, fisheries, the management of drainage basins, and hydroelectricity.

Third, the MRC provides its stakeholders with *forums*, where representatives of each country and other stakeholders attend to discuss various issues such as flood, droughts, storm, basin planning, water utilization, fisheries, irrigation, agriculture, agroforestry, and hydropower.

Policy Recommendation 6: the MRC

The MRC is an official institution, a group of experts, and a forum for its members, China, Burma, and other regional and international communities to communicate and work together. But effectiveness and efficiency in planning, managing, and supervising this international basin are most probably a concern for at least 75 million of the people, who depend directly on the fisheries and agriculture in the basin. Accordingly, there are two recommendations for this institute:

First, *membership*: this international river needs full membership for all the countries: China, Burma, Laos, Thailand, Cambodia, and Vietnam. China and Burma might continue to be observers because of their concerns about national sovereignty, but that is not the right approach in managing one of the most contested trans-boundary water and resources in the world. Full membership means all countries operate fully as a team with mutual honesty, respect, and regional unity.

Second, *development cooperation*: there are many collective agreements, memorandums, and meetings for cooperation and economic growth. But surprisingly, there is much difference in terms of who benefits from what and how from this basin. China, Laos, Thailand, and Vietnam have tried to take as many advantages as possible through their dam, navigation, and irrigation projects. Cambodia and Burma are comparatively the smallest

beneficiaries of the basin. Therefore, development cooperation should focus more on a master plan for regional development, which will benefit the region as whole rather than individual countries. In addition, good governance, like other recommendations, should be incorporated in all basin project designs, implementations, and managements.

VI. Conclusion

The Lancang-Mekong River basin is one of 276 international rivers, crossing six countries: China, Burma, Laos, Thailand, Cambodia, and Vietnam. From 1952 to 2010, each riparian has tried to make the best use of the water, creating 190 events in this basin. These events are illustrated in two graphs showing the frequencies and the temporal trends of the events, which are conflictive (42 incidents), neutral (13 incidents), and cooperative (135 incidents). Like the literature review in general, this finding shows that there are more cooperative events than conflictive ones in this basin.

As demonstrated by the findings presented in this essay, six outstanding factors that are found in those events are: dam development, navigation projects, drought, flood management, development cooperation, and the MRC. The dam and navigation projects are very unique in the way that they are found in both conflicts and cooperation while the drought is in conflicts. On the contrary, the rest are factors found in cooperation.

The Chinese dams are, for instance, believed to cause drought and problems for aquatic resources, fisheries, and the environment in the basin, but Thailand supports a few mainstream Chinese dams since Thailand benefits from its irrigation and flood management programs. Laos, with ambitions similar to those of China, wants to become a source of energy in South East Asia, selling electricity to all neighboring countries. Surprisingly, there are hundreds of dam development projects being studied, commissioned, and operated in all countries, especially China, Laos, Thailand, and Vietnam. "If riparian nations choose to continue on their current course, the Mekong River, a crucial part of their economic growth and a source of livelihood for tens of millions of people, will be in peril during the coming decades" (Parameswaran, 2010, p. 5).

Nevertheless, it is observed that these countries have worked together in all outstanding factors associated with cooperation: flood management, development cooperation, and the MRC. The 1995 Mekong Agreement on the “Cooperation for the Sustainable Development of the Mekong River Basin” reaffirms and expands the globally acknowledged “Spirit of Mekong Cooperation” created in 1957. The 1995 Agreement and Procedure of the MRC calls for “Meeting the needs, keeping the balance”.

Although there are generally more cooperative events than conflictive ones in this international basin, there is still much room for improvements, which can be potential topics for future researches as well. For example, China and Burma need to become members of the MRC. Cambodia is most likely to suffer from the most losses and disadvantages but found to be in a poorer position in influencing its neighbors. The MRC should be more practical, moving from theoretical to effective and efficient implementation. Furthermore, one master plan should be created for all riparian countries, so that the possibility of competition will not be an issue of concerns. Finally, good governance should be applied to every hydro-related project in this most recently contested basin.

References

- Apichai, Sunchindah. 2013. *The Lancang-Mekong River Basin: Reflections on cooperation mechanisms pertaining to a shared watercourse*. NTS Policy Brief, No. PO13-01 (Singapore: RSIS Center for Non-Traditional Security (NTS) Studies, 2013).
- Baird, Ian G. 2011. *The Don Sahong Dam*. *Critical Asian Studies*. Vol. 43, No. 2, Page: 211-235.
- Baran, Eric; Jantuen, Teemu; & Chiew Kieok, Chong. 2007. *Values of inland fisheries in the Mekong River Basin*. WorldFish Center, Phnom Penh, Cambodia. ISBN: 978-9995-71-01-1. 76 pages.
- Baran, Eric & Somountha, Mith. *Fish Biodiversity along the Mekong River from the Himalaya to the coast*. WorldFish Center. Website: http://www.jsps.go.jp/english/e-aststrategy/date/07_asiahorcs_03_p1/keynote/keynote5_%20Baran.pdf. Retrieved on April 5, 2014.
- Barron, Laignee. 2014. *World Wildlife Fund (WWF) criticizes Don Sahong Dam*. Phnom Penh Post (Printed Newspaper), dated on Tuesday, March 04, 2014.
- Consultative Group on International Agricultural Research (CGIAR) Challenge Program on Water and Food. 2013. *Dams in the Mekong Basin – Commissioned, Under Construction and Planned Dams in May 2013*. Vientiane, Lao PDR. Website: http://mekong.waterandfood.org/wp-content/uploads/Draft_A4.pdf. Retrieved on December 10, 2013.
- Economic and Social Commission for Asia and the Pacific (ESCAP) & Mekong River Commission (MRC). 2002. *Recommended Aids to Navigation Systems on the Greater Mekong River*. Website: <http://www.unescap.org/sites/default/files/navgmr02fulltext.pdf>. Retrieved on March 22, 2014.
- Eidem, Nathan T.; Fesler Kristel J.; & Wolf Aaron T. 2012. *International Cooperation and Conflict over Freshwater: Examples from the Western United States*. *Journal of Contemporary Water Research & Education*. Issue 147, Pages 63-71.
- Fuller, Thomas. 2010. *Countries Blame China, Not Nature, for Water Shortage*. New York Time, Asia Pacific, Bangkok, Website: http://www.nytimes.com/2010/04/02/world/asia/02drought.html?_r=0. Retrieved on March 22, 2014.
- Hirsch, P. & A. Wyatt. 2004. *Negotiating local livelihoods: Scales of conflict in the Se San River basin, Asia*. *Pacific Viewpoint* 45(1), Page: 51–68.
- Hensengerth, Oliver. 2009. *Transboundary River Cooperation and the Regional Public Good: The Case of the Mekong River*. *Journal of International and Strategic Affairs*. Vol 31, No 2, Page: 326-349.

Hortle, K.G., S. Lieng; & J. Valbo-Jorgensen. 2004. *An introduction to Cambodia's inland fisheries*. Mekong Development Series No. 4. Mekong River Commission, Phnom Penh, Cambodia. 41 pages. ISSN 1680-4023.

Hruby, Denise. 2014. *WWF finds research on Don Sahong Dam flawed, unscientific*. The Cambodia Daily (Printed Newspaper), dated on Tuesday, March 04, 2014.

International Center for Environmental Management (ICEM). 2010. *MRC Strategic Environmental Assessment of hydropower on the Mekong mainstream*, Hanoi, Vietnam. Website: <http://www.mrcmekong.org/assets/Publications/Consultations/SEA-Hydropower/SEA-Main-Final-Report.pdf>. Retrieved on December 20, 2013.

International Conference on Water and the Environment (ICWE). 1992. *Dublin Statement and the Conference Report*. Website: <https://www.wmo.int/pages/prog/hwrp/documents/english/icwedece.html>. Retrieved on April 1, 2014.

International Rivers Network. 2002. *Navigation project threatens livelihoods, ecosystem*. Briefing Paper No. 2. Berkeley. CA. Website: <http://www.internationalrivers.org/files/attached-files/02.navfactshet.pdf>. Retrieved on November 25, 2013.

John, Dore; Louis, Lebel; & Francois, Molles. 2012. *A framework for analyzing transboundary water governance complexes illustrated in the Mekong Region*. Journal of Hydrology. 466–467, Page: 23–36.

Joy, Christopher. 2012. *Impact & Management of Floods & Droughts in the Lower Mekong Basin & The Implications of Possible Climate Change*. Flood Management and Mitigation Program. Mekong River Commission. Work Paper 2011-2015.

Kayo, Onishi. 2011. *Reassessing Water Security in the Mekong: The Chinese Rapprochement with Southeast Asia*, Journal of Natural Resources Policy Research, 3:4, 393-412, DOI: [10.1080/19390459.2011.607962](https://doi.org/10.1080/19390459.2011.607962).

Leitsinger, Maranda. 2010. *Drought grips parts of China, Southeast Asia amid dam concerns*. CNN. Website: <http://www.cnn.com/2010/WORLD/asiapcf/04/06/china.mekong.river.thailand.laos/>. Retrieved on March 22, 2014.

Marks, Danny. 2011. *Climate Change and Thailand: Impact and Response*. Contemporary Southeast Asia. Vol. 33, No. 2, Page: 229–58 DOI: 10.1355/cs33-2d.

Mekong River Commission (MRC). 2010. *State of the Basin Report 2010*. Mekong River Commission, Vientiane, Lao PDR.

ISBN 978-993-2080-57-1. Website: <http://www.mrcmekong.org/assets/Publications/basin-reports/MRC-SOB-report-2010full-report.pdf>. Retrieved on February 20, 2014.

Mirumachi, N.; & M. Nakayama. 2007. *Improving methodologies for transboundary impact assessment in transboundary watercourses: Navigation channel improvement project of the Lancang-Mekong River from China-Myanmar boundary marker 243 to Ban Houei Sai of Laos*. International Journal of Water Resources Development 23(3): 411–425.

MRC. 2000. *The Mekong – Map: International River Basins of Asia, the Mekong River Basin*. Website: http://webworld.unesco.org/water/wwap/pccp/useful_links/mekong_maps.shtml. Retrieved on April 11, 2014.

National Oceanic and Atmospheric Administration (NOAA). *Definitions of Flood and Flash Flood*. Website: http://www.srh.noaa.gov/mrx/?n=flood_and_flash. Retrieved on April 01, 2014.

Parameswaran, Prashanth. 2010. *Averting Crisis on the Mekong River*. Project 2049 Institute. Futuregram 10-001. Website: http://project2049.net/documents/averting_crisis_on_mekong_river_parameswaran.pdf. Retrieved on February 10, 2014.

Pearse-Smith, Scott W.D. 2012. 'Water war' in the Mekong Basin? Asia Pacific Viewpoint, Vol. 53, No. 2, ISSN 1360-7456, Page: 147–162.

Pech, Sokhem. 2011. *UN Watercourses Convention and Greater Mekong Sub-region*. UN Watercourses Convention and Greater Mekong Sub-region. Website: <http://www.unwatercoursesconvention.org/images/2012/10/Mekong-and-UNWC.pdf>. Retrieved on April 17, 2014.

Radosevich, G. E. *NEGOTIATE Toolkit: Case Studies - Mekong River Basin, Agreement & Commission Case Study*. IUCN Water Program; Website: <http://cmsdata.iucn.org/downloads/mekong.pdf>. Retrieved on April 6, 2014

Radosevich, G. E., & Olson, D.C. 1999. *Existing and Emerging Basin Arrangements in Asia: Mekong River Commission Case Study. Paper presented at the Third Workshop on River Basin Institution Development*. Website: <http://siteresources.worldbank.org/INTWRD/918599-1112615943168/20431963/MekongRiverComCaseStudy.pdf>. Retrieved on April 17, 2014.

Schmeier, Susanne. 2009. *Regional Cooperation Efforts in the Mekong River Basin: Mitigating river-related security threats and promoting regional development*. Austrian Journal for Southeast Asian Studies, Vol. 2, No. 2, Page: 28-52.

Schrodt, Philip A. 1993. *Event Data in Foreign Policy Analysis. Foreign Policy Analysis: Continuity and Change in Its Second Generation*. New York: Prentice. Website:

<http://www.parusanalytics.com/eventdata/papers.dir/Haney.pdf>. Retrieved on November 28, 2013.

Shapiro-Libai, Nitza. 1969. *Development of International River Basins: Regulation of Riparian Comp Competition*. Indiana Law Journal. Vol. 45, Iss. 1, Article 2, Page: 19–55.

Snidvongs, Anond; Choowaew, Sansanee; & Chinvanho, Suppakorn. 2003. *Background Paper: Workshop on Impact of Climate Change on Water and Wetland Resources in Mekong River Basin*. Directions for Preparedness and Action. International Union for Conservation of Nature. Southeast Asia START Regional Center Report Number 12.

Son, Johanna. 2010. *Mistrust lingers over dams*. Asia Times Online. Website: <http://www.atimes.com/atimes/China/LD08Ad03.html>. Retrieved April 8, 2014.

Transboundary Freshwater Dispute Database (TFDD). 2010. *Event Database*. The Program in Water Conflict Management and Transformation. Website: <http://www.transboundarywaters.orst.edu/>

United Nations Educational Scientific and Cultural Organization (UNESCO). 2013. *What is water cooperation?* UN World Water Day. International Year of Water Cooperation. Website: <http://www.unwater.org/water-cooperation-2013/water-cooperation/water-cooperation/en/>. Retrieved on April 10, 2014.

United States Environmental Protection Agency (US EPA). *Glossary of Climate Change Terms*. Website: <http://www.epa.gov/climatechange/glossary.html>. Retrieved on April 4, 2014.

United States Geological Survey (US GS). *Definition of Drought*. Website: <http://md.water.usgs.gov/drought/define.html>. Retrieved on April 5, 2014.

Voice of America (VoA). 2010(a). *Drought Drops Mekong River to 50-Year Low, Affects Farmers and Trade*. VOA News Online. Website: <http://www.voanews.com/content/drought-drops-mekong-river-to-50-year-low-farmers-and-trade-affected-89506507/114976.html>. Retrieved on March 12, 2014.

VoA, 2010(b). *Southeast Asia Drought Triggers Debate Over Region's Water Resources*. VOA News Online. Website: <http://www.voanews.com/content/southeast-asia-drought-triggers-debate-over-regions-water-resources--89114447/114686.html>. Retrieved on March 22, 2014.

Wolf, Aaron. 2007. *Shared Waters: Conflict and Cooperation*. Department of Geosciences, Oregon State University, Corvallis, Oregon. Website: http://www.transboundarywaters.orst.edu/publications/abst_docs/wolf_2007_shared_waters.pdf. Retrieved on March 01, 2014.

Wolf, Aaron T.; Yoffe, Shira B.; & Giordano, Mark. 2003. *International Waters: identifying basins at risk*. Water Policy 5. Page: 29-60. Website: <http://www.environmental-expert.com/Files%5C5302%5Carticles%5C5877%5C2.pdf>. Retrieved on April 25, 2014.

Yoffe, Shira; Wolf, Aaron, T.; & Giordano, Mark. 2003. *Conflict and Cooperation Over International Freshwater Resources: Indicators of Basins at Risk*. Journal of the American Water Resources Association (JAWRA) 39(5):1109-1126.

Yoffe, Shira & Larson, Kelli. 2001. *Chapter 2 Basin At Risk: Water Event Database Methodology*. Department of Geosciences. Oregon State University. Website: http://www.transboundarywaters.orst.edu/research/basins_at_risk/bar/BAR_chapter2.pdf. Retrieved on December 02, 2013.

Zalinge, N. van; Degen, P.; Pongsri, C.; Nuov, S.; Jensen, J.G.; Nguyen, V.H.; & Choulamany, X. *The Mekong River System. Proceedings of the Second International Symposium on the Management of Large Rivers for Fisheries*. FAO. Website: <ftp://ftp.fao.org/docrep/fao/007/ad525e/ad525e14.pdf>. Retrieved on January 10, 2014.

Ziv, Guy; Baran, Eric; Nam, So; Rodríguez-Iturbe, Ignacio; & Levin, Simon A., 2012. *Trading-off fish biodiversity, food security, and hydropower in the Mekong River Basin. Proceedings of the National Academy of Sciences of the United States of America*. Vol. 109, No 15; Page: 5609-5614; Website: <http://www.pnas.org/content/109/15/5609>. Retrieved on April 10, 2014.

– The End –