

Living with Flood in the Mekong Delta, Vietnam

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ABSTRACT

The paper presents a overview on natural and historical context of the agriculture colonization of the Mekong Delta in Vietnam in highlighting the manner how the people have been living with flood throughout the centuries. The main issue dealt in this paper is how the people in Mekong Delta in Vietnam adapt the rice cropping calendar to profit annual flood as the main natural fertilizer and to reduce flood impacts on paddy fields. The information collected from different sources are presented in the paper to show that in spite of the flood the demography growth is increased through the time and linked to agriculture expansion in the Delta.

The paper deals also with negative impacts of flood on the livelihood of local people and the consequences of infrastructures installation in the Delta as the main human intervention that deteriorates the natural balance created by flooding.

1. Introduction

Living with flood in the Mekong delta is no more a new concept as many people thought. Various studies have been made on this issue using different approaches. This paper provides another view point with which we are looking backward to the history of both bio-physical evolution and in the same time, agriculture and demography development of the delta in trying to demonstrate that living with flood is result of long history of the delta colonization and settlement of many generations. Flood is one of regular and annual phenomena of Mekong Delta and issues a double effect on the colonization and settlement in the delta. In one hand, annual flood brings a lot of fertilizing materials conditioning huge space of paddy fields. In the other, flood cause a lot of destructive impacts and in many case, disaster on human life. The human intervention in the natural structure of the delta participates in reducing the positive impacts of the flood in increasing the damages.

In the context where Mekong Delta is considered as one of the most affected by climate change the concept “living with flood” should be reviewed in a new point of view and the decision making system needs to adapt the experiences accumulated from generation to generation of the people living on this territory.

To understand the interaction man-flood to live with flood in the delta it is necessary to review its key factors and our paper will deal with delta development from both bio-physical context of flooding and agriculture activities on this territory.

2. Flood Related Bio-physical Context of Mekong Delta

2.1 Geographic features

Mekong River Delta is one of the world largest delta with a surface of 49,1 thousand km² including 40,5 thousand km² in Vietnam territory (Erison J. P., VÖrÖsmarty C. J. et al. 2006). The Mekong is a largest river in Southeast Asia and its length estimated is 4,200km with mean discharge of 13.974 m³/s and annual total discharge of 550 km³ (Ministry of Natural Resources and environment MONRE Vietnam 2004). The monsoon climate covers all river basin and induce a seasonal variation in flow with several peaks of discharge appeared during rainy season.

The soil in the Mekong River Delta is estimated as a high fertile land for agriculture, and thanks to high radiation the rice crops in this area get a high yield and supply more than half of annual country's cereal production.



Figure 1: Hydrographic network and flooded area in Mekong River Delta in 2000 (Source: Radarsat Int.).

2.2 Flood in the Mekong river delta

2.2.1 Flood in main stream

Firstly, flood may be considered as a annual natural event in rainy season in the Mekong River catchment **Error! Reference source not found..** Annual flood pattern of the Mekong River is normally more reduced than illustrated in **Error! Reference source not found.** which shows the flooded area in 2000. During flood season, water level may change 10-12m with a high steepness of 0.8-1.5m/day in the middle reach. When flood flow enters the delta, near the PhnomPenh city, it is pushed up one part into the Tongle Sap Lake and other one into two branches downstream (Mekong and Bassac branches). Meanwhile, the Tongle sap Lake with an area of 2,700 square km and increasing to 16,000 square km may store annually about 70×10^9 m³ of water. Consequently, the peaks of flood delay as the rules, more than one week from Kratie/Kompong Cham stations in Combdia to Tanchau station located at Cambodia-Vietnam border (Dang Hoa Vinh and Le Xuan Thuyen, in press) (**Error! Reference source not found.**).

In the lower part of the delta (Vietnam territory) the flood pulse is modified and the water level rise is relatively slow of 5 -7 cm/day on average and maximum rate of up to 0.20 m/day (Dang Hoa Vinh and Le Xuan Thuyen, in press). The hydrography (fig. 3) represents a regulatory role of the Tongle Sap Lake to smooth down the water level curves from

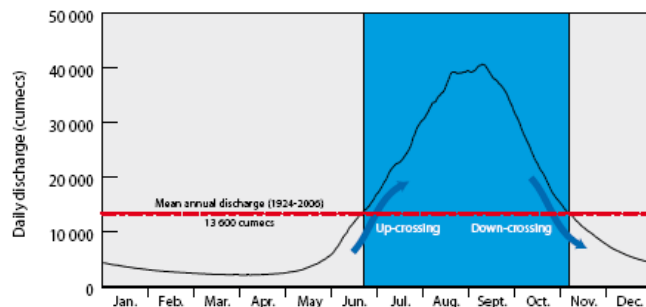


Figure 2: Definition of the flood season, with the mean annual hydrograph at Kratie as an example
(http://www.mrcmekong.org/flood_report/2006/about-foods.htm)

Kompong Cham to Tanchau stations.

According to the flood classification of Southern Meteo-hydrological service in HCMC, during last 40 years (1961-2001) there have been observed in the Mekong delta:

- 11 great floods with maximum water level at Tanchau station over 4,5m above msl.
- 25 average floods with maximum water level at Tanchau station ranged 3,7 - 4,5m above msl.
- 7 low flood with maximum water level at Tanchau station below 3,7m above msl.

It is to confirm that the flood in 2000 year is estimated as the worst flood during the last 70 years (see Figure 3).

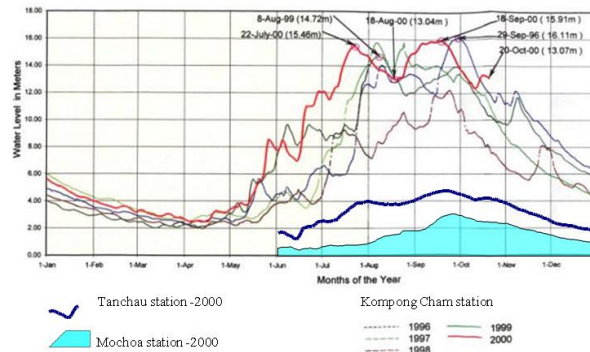


Figure 3: Water level of floods 1996, 1997, 1998, 1999 and 2000.

2.2.2 Water in floodplain

Flood pulse overflows the river banks while the water level rises over 17 m above msl at Kratie station and subsequently over 3,5m at Tanchau station. In consequence, in the delta, the lower land behind the river banks is flooded by overflow coming from water body staying earlier in the upstream floodplain (in Cambodia) and direct overflow from the Mekong mainstream. Due to the fact that friction the flood pulse is harmonized on the plane surface of deltaic floodplain and the steepness of water level rise decreases respectively in comparison with steepness in main stream (cf. hydrograph at stations Tanchau and Mochoa in **Error! Reference source not found.**).

According to “Practice guidelines” edited by Mekong River Commission (2009) [Best Practice Guidelines for the Integrated Planning and Design of Economically Sound and Environmentally Friendly Roads in the Mekong Floodplains of Cambodia and Viet Nam. MRC Flood Management and Mitigation Programme, Oct. 2009] water depth projected to the worst flood 2000 is inclined from 5 - 8 m nearby PhnomPenh city to 1 - 2 m in Vietnam floodplains. And water level rises in range of 5 -7 cm/day on average. The flooded area expands 1,4 to 2 million hectares (in Vietnam territory) corresponding to low flood or great flood. In this vast water surface, the flow is not much strong however there occur frequently the unexpected dangerous events such as high waves during heavy rain or strong wins.

Additionally, the heavy rainfall in latter rainy season and the tidal fluctuation influence or prolong remarkably the water drainage from the floodplain. Normally, flood prolong from middle August to the end November in the Vietnam floodplains. However, the recent water regime is changed considerably in raison of raising human interventions.

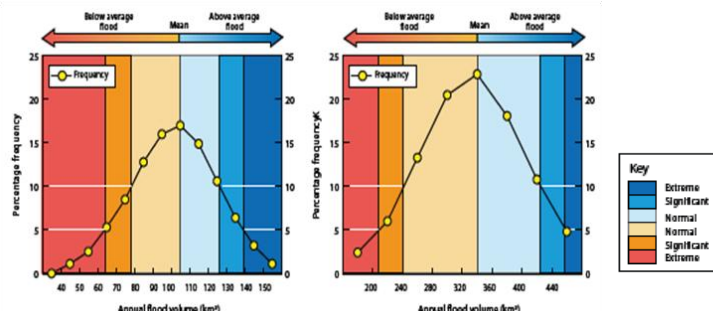


Figure 4: Frequency histograms of the historical distribution of the annual flood volumes on the Mekong mainstream at Vientiane (left) and Kratie (right).

3. Agricultural Colonization of the Delta-A History of Cohabiting with Flood

Looking backward in the pre-historical epoch, the data show that the floods, agriculture activities and housing style in the delta have been closely linked. According to archeological researches, human imposed first footprint in delta environ 5000 BP in the middle and lower parts of the Mekong basin (Carbonnel J.P and 1972). As shown in **Error! Reference source not found.**, in parallel with human expansion, the agriculture - rice cultivation appeared also early, about 3600, near the top of the delta (Li Vanna 2005) and it may have been earlier, 5000 BP, as suggested by Xiaoqiang Li et all (2009) (Xiaoqiang Li, John Dodson et al. 2009).

This promised land supported large expansion of well-known Funan Kingdom a few centuries BC and of subsequent Angkor civilizations. However, in reason of flooding in the Mekong delta, the Funan people had to reside somewhere in the houses on stilts (**nhà sàn**) in ancient floodplain (Bùi Phát Diệm, Đào Linh Côn et al. 2001).

As a peaceful niche and naturally favorable for agriculture especially rice cropping the human settlement far in the past has been continued and actually Mekong River Delta becomes a densely populated area (see Figure 7)

Man-made construction such as canals, roads, dykes and embankment induce a crucial change of nature in the deltaic morphology, particularly natural drainage systems in the floodplains. However, until now the hydrologists consider the Mekong Basin has remained relatively intact, but the current plans for rapid development in the hydropower sector may threaten the riverine ecosystems and flood regime in the floodplains. In fact, the floodplains produce a few time as much fish per area as the main channel.

Until first haft of XX century, the majority of residents (around 2 million) lived in small riverside villages in the relatively high ground under level natural/river bank. They cultivated one crop/year with rain-fed/or floating rice during rainy season in the rice field adjacent to the riverbanks in the low land of floodplains and kept a subsistence farming of live (self-supplying live style). Some of floating rice varieties may grow-up a few centimeters/day and

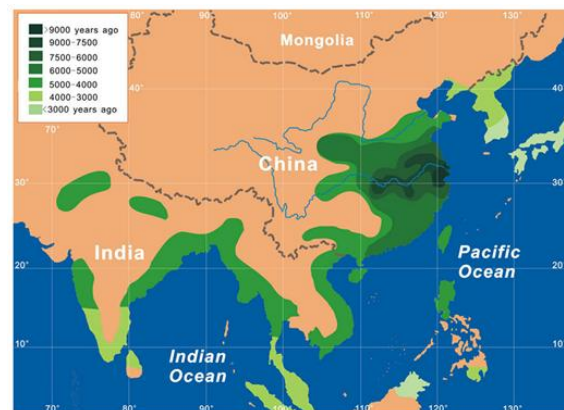


Figure 7: Increases of population and expansion of rice agriculture in Asia, and anthropogenic methane emissions since 5000 BP

(Xiaoqiang Li, John Dodson et al. 2009)

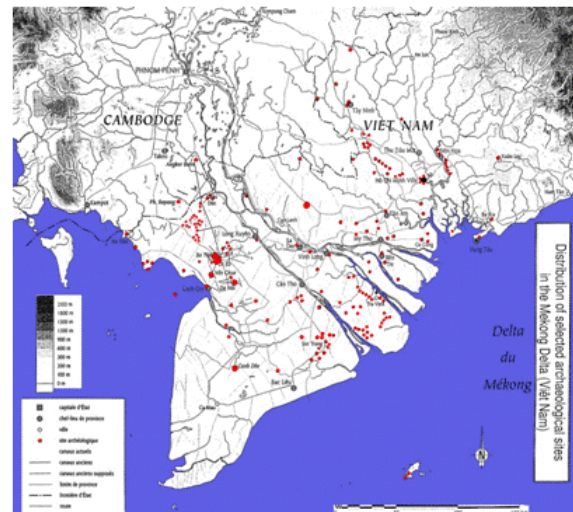


Figure 7; Main Archeological Site in the Delta (Mission Archeologie du delta du Mekong, Rapport d'activites 1997-2000, EFEO)

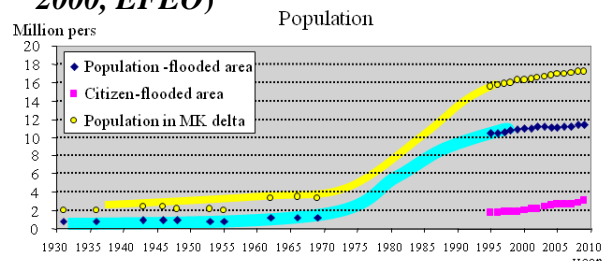


Figure 7: Population growth in Mekong delta

survive flooding. It seems their life was threatened little with flood or old residents were friendly adapted to water fluctuation as it is described as riverine culture by several writer- historians. In spite of low technique of cultivation, the hard efforts of farmers changed really the MK delta into a main rice exporting region from beginning of XX century. As shown in **Error! Reference source not found.**, the people has mastered the agriculture system to maximize the productivity of rice cropping in accordance with flood calendar in an adaptive way since many generations. The cropping calendar changed totally to adapt the flood calendar and the old rain-fed/or floating rice

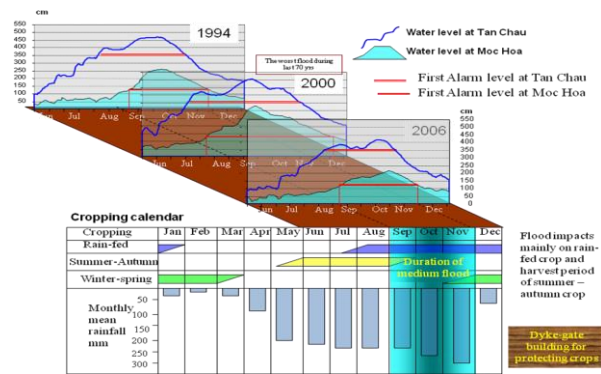


Figure 8: Flood season adaptation for rice cropping calendar.

cultivation in the past is replaced by a new system of 2-3 crops/year and new technique (seed, cultivation, irrigation, chemical fertilizer...) are applied commonly in the rice fields since 80 year from last century and that induce an impressive raising of agricultural production as shown in Figure 9. Among rice crops, the winter-spring crop even supplies a main rice production with high quality/or benefit for farmers in MK and in particular in the flooded area. In parallel with change of farming systems, cultivation more intensive and more people have to stay in the floodplains and their life becomes threatened more with flood. In spite of great risk of flooding Raison d'être for majority of residents staying in flood area is poverty, gap of vocation or unemployment.

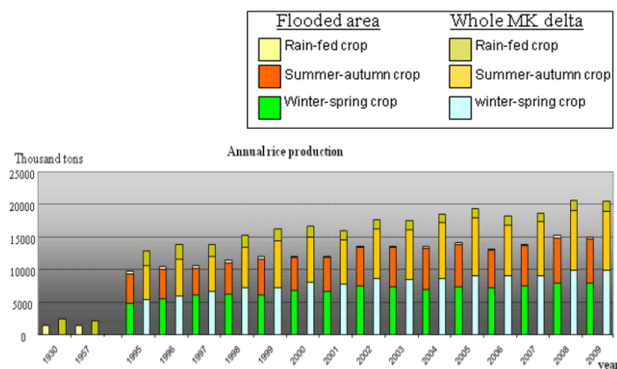


Figure 9: Annual rice production in the delta (Vietnamese general statistics office 2009; The Netherlands delta development team, 1974)

In order to protect rice crops (especially Summer-Autumn crop) against water rising in beginning of flood a widely embankments are invested from government or local communities in the floodplains since last decade. The farmers release gates of sluices to let water enter into rice fields after the harvest finished. These are a dyke systems with height about 1,5 – 2m. Somewhere, the wide dykes has been used for making paved/or unpaved roads. The embankment areas are variable in wide range of hundred to dozen thousand hectares and somewhere the farmers may cultivate successively 3 rice crops/year.

The population increased rapidly in floodplains and we observed a jump-off of population after the war 1975, and proportionally an expansion of rice plantation and also a rise of rice production (see Figure 9). The fig. 9 shows how the important the rice production growth is over the time (form 1930 to 2009).

4. Impact of Flood on Live and Livelihood of the people

In the past, Mekong River Delta was considered as a fertile land with a comfortable life thanks to favorable natural conditions, however from the recent rate of income per capita

decreases clearly in comparison with other area, especially, with adjacent Southeast upland (Dong Nam Bo). The infrastructure and life standards in flooded area are in low level, most of residence is the fragile temporary houses (thatched houses – nhà lá).

Recent report of demonstrates that the percentage of solid permanent houses in the Mekong delta is lower among 6 regions in Vietnam and this value much be lowest in the floodplains (5.5 – 14.7%). This parameter and other (education, labour-employment, healthcare, income, electricity, access to save drinking water, sanitary...) reveal that the recent living standards in the flooded area in Mekong delta are low in comparison with average level in country.

Table 1: Percentage of households, 2008

Region	Permanent house	Semi-permanent house	Temporary and other house	Homeless family
Red River Delta	51.9	46.5	1.6	1.9
Northern midland and mountain areas	25.7	58.6	15.7	3.1
North central areas and central coastal area	17.8	75.5	6.7	8.0
Central highlands	14.7	72.4	13.0	1.0
South East	30.5	60.9	8.6	5.7
Mekong River Delta	11.4	51.9	36.7	5.7

Table 2: Total damage of severe flooding in MK delta (Vietnam)

	1978	1984	1991	1994	1995	1996	1997	2000	2001	2005
Human loss (children) (Unit:Person)	87	105	158	407 (265)	199 (180)	250 (160)	607	539 (>300)	251 (202)	49
Damaged house (Unit:Family)	57005	41835	185127	593107	26326	42150	99238	890000	265000	6842
Rice areas damaged (Unit:Hectare)	307100	175626	171898	26868	11101	60368	19758	224508	-	8364
Estimated damage (Unit:10 ⁸ VND)	1261	1247	883	2284	700	2673	6966	4626	760	-

5. Conclusion

Bio-physic context of Mekong Delta in Vietnam has shaped its specific colonization and settlement history and flood is one of the key factors of this process. Cohabiting with flood in this case is to exploit the resources brought by annual flood and to cope and to adapt the impacts of flood. The demographic growth in the delta is accompanied by agriculture expansion that adapts well the flood.

The negative, frequently catastrophic impacts of flood remains unavoidable and in many case are the consequence of human intervention. The historical experiences of the local population should be reviewed in the process of decision making especially in the context of climate change.

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