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Public participation in erosion monitoring on Mekong mainstream

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Abstract

According to the construction of Xayaburi hydropower project in Laos, people along the Mekong River especially Thai people are worried about the impacts regarding to the development of hydropower projects on bank erosion. This research has an objective to create the procedure to observe the changing of river bank and increase scientific knowledge of local Thai people along the Mekong mainstream in order to adapt their livelihood. This research has provided the procedure of erosion monitoring through the forum among academic sector, governance sector and public sector in 32 villages of 8 provinces in Thailand along Mekong mainstream. Four rows of 4-inches wooden pegs were installed in pilot study areas at Songkram confluence in Chaiburi sub-district, Tha Uthen district, Nakhon Phanom province. This bank erosion changing was observed by a team that established from researchers and local people. From the observation, the vertical height of wooden pegs appears to present the values of the eroding and depositing which are occurred on the Mekong river bank. On November 24, 2015, it is found that the lowest station of wooden peg that close to Mekong River level is tilting about 30 degree, and appear the eroding is about 700 millimeters. So, the team has concluded that this eroding is the highest risk case of erosion in this study. In addition, this research also increase scientific knowledge of local people in the changing mechanism of bank slope due to the change of water level and flow of Mekong River, the application of this procedure has agreed to broaden to other areas along Mekong Mainstream.

Keywords: Erosion monitoring, Public participatory, Mekong mainstream, Songkram confluence, Bank erosion, Scientific knowledge

1. Introduction

Mekong River is one of great river in the world that has a lot of potential to develop hydropower project. Currently in the Upper-Mekong River especially in China, six hydropower dams; Xiaowan Dam, Jinghong Dam, Dachaoshan Dam, Manwan Dam, Nuozhadu Dam and Gongguoqiao Dam are operating while the first dam in Lower-Mekong River named Xayaburi Hydropower project in Laos is under construction and other 10 dams is on the plan as detailed in Figure 1 [1]. According to the construction of Xayaburi hydropower project in Laos, people along the Mekong River especially Thai people are worried both direct and indirect impacts regarding to the development of many hydropower projects on Mekong mainstream and its tributary that will effect to their livelihoods in terms of small-scaled fisheries, economic system, ecology system and so on.

The erosion along the river bank is one of the major factors that causes the problems e.g. the soil infertility and losing of planting areas. In contrast the sediment along the river will cause the shallowness of river, river delta and may increasing some of planting areas. Two main objectives of this study are observation of river bank changing (erosion and deposit) and developing of local people scientific knowledge in order to adapt their livelihood according to the development of those 11 hydropower projects in Lower Mekong River that will be operate in the next few years. Therefore the erosion and deposit monitoring procedure has to be created by public sector collaborations. The pilot study areas for this study covered the area of Songkram confluence along the Mekong mainstream as illustrated in Figure 2.

2. Methodology

The researchers, local Thai people in 32 villages of 8 provinces and Department of Water Resources are collaborate and arranged 4 forums: 1st forum held on May 29, 2015 at Ubonratchathani (participants from Ubonratchathani and Amnart Charoen), 2nd Forum held on June 2, 2015 at Mukdaharn (participants from Nakhon Phanom and Mukdaharn), 3rd Forum held on June 5, 2015 at Nong kai (participants from Nong kai, Bungkan and Loei) and 4th Forum held on June 10, 2015 at Chiangrai (participants from Chiangrai), in order to discussion on the selection of pilot study area, form a group of monitoring team and finally create procedure for monitoring river bank erosion and deposit based on public benefit that is the core point.

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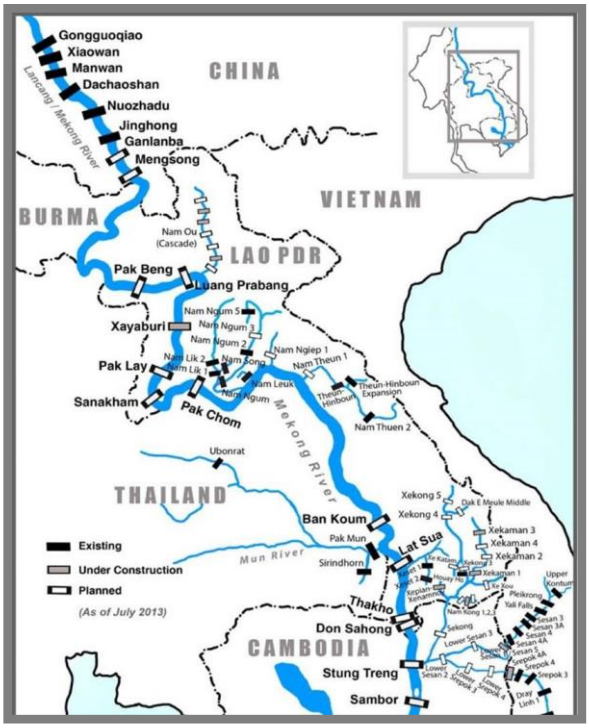

Figure 1 Proposed hydropower development project in Mekong mainstream [2]

Figure 2 Two pilot study areas along Mekong mainstream

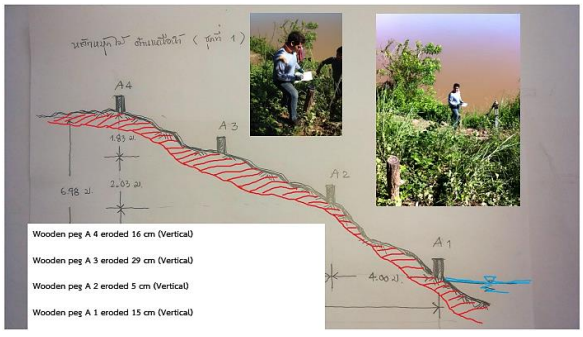

Figure 3 5thMonitoring of wooden peg in Line A at Ban Na Nong Bok (upstream)

The team has chosen 2 pilot study areas that located on upstream and downstream of Songkram confluence which are situated at Chaiburi sub-district, Tha Uthen district, Nakhon Phanom Province. The first pilot study area is located at Ban Na Nong Bok, and the second pilot study area is located at Ban Tan Pak Nam, as shown in Figure 2.

On May 30, 2015, the team has started to install the wooden pegs on the river bank of pilot study areas by using clamshell digger to make the 6-inches holes with 1 meter depth. After the hole has made, 4-inches diameter of wooden peg will insert to its desirable depth and then backfill the hole with original soil and compact soil in every 20 cm thick of each layer by using wooden tamping rod to ensure that all installed wooden peg can be stand in long period. The wooden peg is made of local material that came from trees, cheaper, available, eco-friendly, nontoxic, durability, and capable to installation by using traditional fashion.

After wooden pegs has installed, the vertical height of each pegs above bank slope have to be recorded in tabulation. In the initial stage, on 30 May 2015, heights of all 19 wooden pegs are set to be 500 millimeters in vertical above the bank slope. The spacing of every wooden peg in one row is approximate 2 to 4 meters it depends on topography of river bank and suitability.

The specific pilot study area has covered 600 square meters for each upstream and downstream (30 m x 20 m approximately). The team has visit on site 5 times within 6 months to observe and survey the changing of river bank by taking pictures, hand sketching and record in tabulation in order to monitor the Mekong river bank erosion and deposit. The observations are started from end of May 2015 and completed on end of November 2015 which is cover both drought and flood period.

3. Results and discussion

The five monitoring of Mekong mainstream are as following;

1st Monitoring : In the early morning on May 30, 2015, on the upstream, both parties of participators and researchers has started to install 2 rows of 4-inches diameter of wooden pegs which spacing of 20 meters in between each rows. The pegs in the same row has spacing of 2-4 meters which are started from toe and go up to top slope of the river bank to ensure that the installed pegs can be monitored the changing of bank slope. In the afternoon the team has moves to downstream to install another 10 wooden pegs.

2nd Monitoring: On June 30, 2015, the team has observe and survey on site, and found that nothing change from 1st monitoring due to the same drought period and water level also has not change, the height of every wooden pegs still 500 millimeter vertically above the existing ground level of bank slope.

3rd Monitoring: In the monsoon period, the team has observe and survey at site on August 07, 2015, and found that every wooden peg in both upstream and downstream are under the water due to rainy season and flood period, and impossible to record the height of all wooden peg under water.

4th Monitoring: at the end of monsoon period, the team has visit the site to observe and survey the changing of river bank on September 16, 2015, and found that few of wooden pegs are above the water level and some are still flooded due to the end up of the rainy season and Mekong River water level still high. And the team has found the ripple mark of water level that shown along river bank. The team has take picture and also record the height of few wooden pegs which appears both shorter and longer than 50 cm to present both eroding and depositing along river bank as illustrated in Table 1.

5th Monitoring: On November 24, 2015, the team has observe and survey at site, and found that all wooden pegs are above the water due to the coming of dry season, the level of Mekong River is back to the lowest level. Additional, the team has found that at toe slope in row D, the wooden peg is tilting about 30 degree from vertical, and the measured vertical height of this wooden peg is about 120 cm, therefore the team observe that this peg is eroded 70 cm (120 cm – 50 cm) and the team has concluded that this is the highest risk case of erosion in this study as shown in Figure 3 to 6.

The record data and details of Mekong River bank erosion of specific pilot study area are illustrated in Table 1.

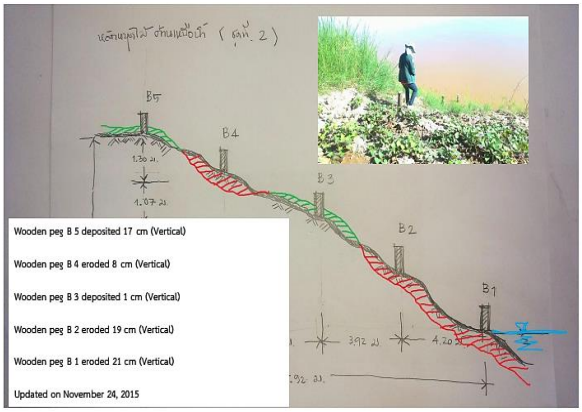

Figure 4 5th Monitoring of wooden peg in Line B at Ban Na Nong Bok (upstream)

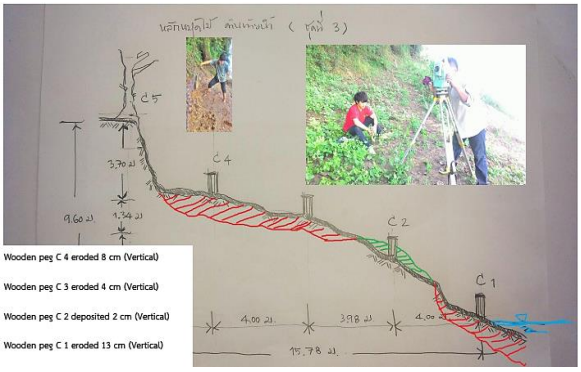

Figure 5 5thMonitoring of wooden peg in Line C at Ban Tan Pak Nam (downstream)

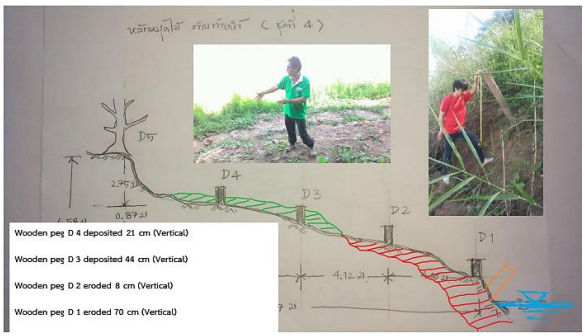

Figure 6 5th Monitoring of wooden peg in Line D at Ban Tan Pak Nam (downstream)

Table 1 Monitoring and Analysis of Wisdom Vertical of Bank Erosion Rate per year

Peg no.	Installation and 1st Monitoring 30 May 2015	2nd Monitoring 30 June 2015		3rd Monitoring 7 August 2015		4th Monitoring 16 September 2015		5th Monitoring 24 November 2015		Wisdom Vertical of Bank Erosion Rate (WVBER) Updated 24 Nov 2015
	Height of Peg (cm.)	Height of Peg (cm.)	Erosion (cm.)	Height of Peg (cm.)	Erosion (cm.)	Height of Peg (cm.)	Erosion (cm.)	Height of Peg (cm.)	Erosion (cm.)	mm / year
A 1	50	50	0	n/a	n/a	n/a	n/a	65	15.00	150.00
A 2	50	50	0	n/a	n/a	n/a	n/a	55	5.00	50.00
A 3	50	50	0	n/a	n/a	45	-5.00	79	29.00	290.00
A 4	50	50	0	n/a	n/a	63	13.00	66	16.00	160.00
B 1	50	50	0	n/a	n/a	n/a	n/a	71	21.00	210.00
B 2	50	50	0	n/a	n/a	n/a	n/a	69	19.00	190.00
B 3	50	50	0	n/a	n/a	n/a	n/a	49	-1.00	-10.00
B 4	50	50	0	n/a	n/a	22	-28.00	58	8.00	80.00
B 5	50	50	0	n/a	n/a	30	-20.00	33	-17.00	-170.00
C 1	50	50	0	n/a	n/a	n/a	n/a	63	13.00	130.00
C 2	50	50	0	n/a	n/a	n/a	n/a	48	-2.00	-20.00
C 3	50	50	0	n/a	n/a	31	-19.00	54	4.00	40.00
C 4	50	50	0	n/a	n/a	46	-4.00	58	8.00	80.00
C 5	50	50	0	n/a	n/a	50	0.00	50	0.00	0.00
D 1	50	50	0	n/a	n/a	n/a	n/a	120	70.00	700.00
D 2	50	50	0	n/a	n/a	36	-14.00	58	8.00	80.00
D 3	50	50	0	n/a	n/a	5	-45.00	6	-44.00	-440.00
D 4	50	50	0	n/a	n/a	25	-25.00	29	-21.00	-210.00
D 5	50	50	0	n/a	n/a	50	0	50	0	0.00

Note WVBER: Wisdom Vertical of Bank Erosion Rate
+ Erosion - Deposit

Note:

1. *The erosion in Col 4 in Table 1 is the height of peg that measured on 30 June 2015(cm) minus height of peg that measured on 30 May 2015(cm).*
2. *The erosion in Col 6 in Table 1 is the height of peg that measured on 07 August 2015 (cm) minus height of peg that measured on 30 May 2015(cm)*
3. *The erosion in Col 8 in Table 1 is the height of peg that measured on 16 September 2015 (cm) minus height of peg that measured on 30 May 2015(cm)*
4. *The erosion in Col 10 in Table 1 is the height of peg that measured on 24 November 2015 (cm) minus height of peg that measured on 30 May 2015(cm)*
5. *The erosion in Col 11 in Table 1 is Wisdom Vertical of Bank Erosion Rate per year, WVBER (millimeter per year) updated on 24 November 2015. This WVBER value is created and agreed by public sector collaboration*
6. *n/a : impossible to measure height of peg due to flooding*

As discussion from 4 forums, the collaboration has agreed to create level of erosion as follows;

Low : WVBER less than + 100 mm / year
Medium: WVBER is in between +100 to +300 mm / year
High : WVBER more than +300 mm / year

4. Conclusions

This research has provided the procedure of erosion monitoring through forum among academic sector, governance sector and public sector in 32 villages of 8 provinces in Thailand along Mekong mainstream. Four rows of 4-inches wooden pegs was installed in pilot study areas on Mekong mainstream at Songkram confluence in Chaiburi sub-district, Tha Uthen district, Nakhon Phanom Province and observed by a team that established from researchers and local people. Height of peg above ground was monitored 5 times within 6 months and present in the form of erosion and deposition. The vertical height of wooden pegs appears both shorter and longer than the existing height (50 cm above ground, installed on 30 May 2015) to present the values of the eroding (+) and depositing (-) which are occurred on the Mekong river bank. Additional, on 24 November 2015 the team found that the lowest station of wooden peg that close to Mekong River level is tilting about 30 degree from vertical, and the vertical eroding is about 700 millimeters and the team has concluded that this is the highest risk case of erosion in this study. After this research, the knowledge of local people has increased on mechanism of erosion and deposition from the change of water level and flow in Mekong River, the application of this procedure has agreed to broaden to other areas along Mekong Mainstream.

5. Recommendation

The researcher recommended that this study should be broaden and further study at least 5 years, to make sure that this research can reflect the changing of bank slope in both short term and long term that caused by development of hydropower projects in Upper and Lower of Mekong River as well as the impact from rainstorm, seasonal and annual change.

Additional, this monitoring procedure can be extend its study area by increasing the number of wooden pegs to applied for the study of losing planting area and household properties. Furthermore, this monitoring procedure can also be set as the local early warning system.

6. Acknowledgements

This research is part of “Transboundary environmental impact in Mekong mainstream due to the development of hydropower project” project. So, the authors would like to thank Department of Water Resources who provided insight and expertise that greatly assisted the research.

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