

# Sumatra Tsunami and securing drinking water

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ภาพข้อมูลดาวเทียมระยะเวลาดำเนินงานเขตรักษาพันธุ์สัตว์ป่า จังหวัดพังงา บันทึกภาพโดยดาวเทียม IKONOS เมื่อวันที่ 11 กุมภาพันธ์ พ.ศ. 2544 และภาพข้อมูลดาวเทียมในบริเวณเดียวกันหลังเหตุการณ์คลื่นสึนามิ เมื่อวันที่ 26 ธันวาคม พ.ศ. 2547 (ภาพข้อมูลบันทึกในวันที่ 29 ธันวาคม พ.ศ. 2547)



รวบรวม วิเคราะห์และประมวลผลโดย ผู้ช่วยศาสตราจารย์ สมบัติ อยู่เมืองและทีมงานศูนย์วิจัยภูมิสารสนเทศเพื่อประเทศไทย (GISTHA) จุฬาลงกรณ์มหาวิทยาลัย [www.gisthai.org](http://www.gisthai.org)

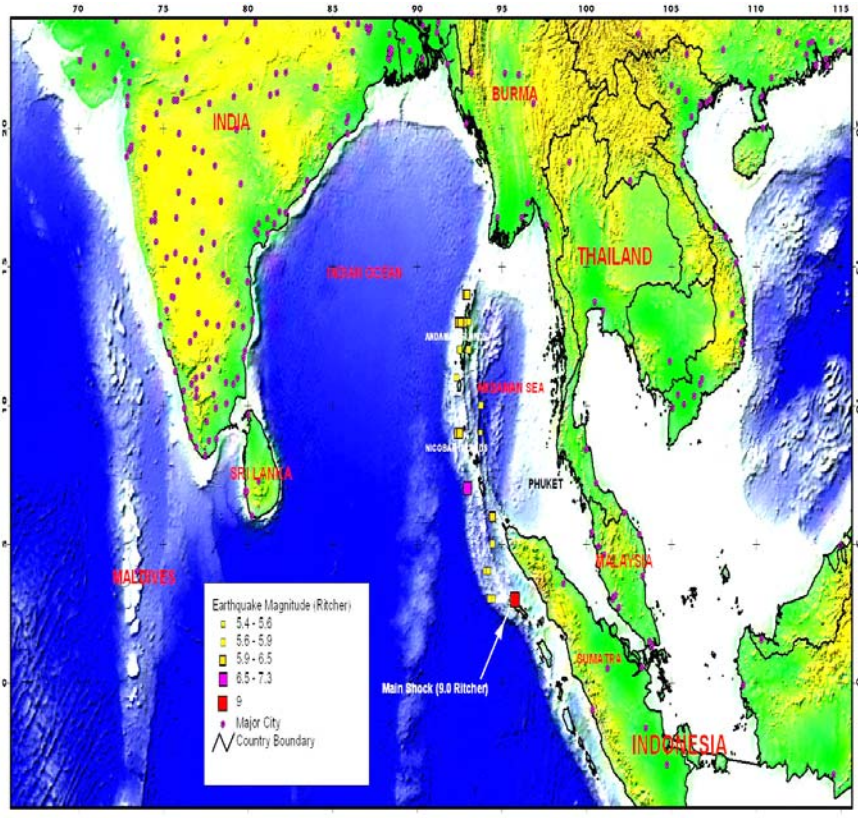
จัดทำเมื่อวันที่ 31 ธันวาคม พ.ศ. 2547 สวณสิทธิ์ ทานฟ้าซ่า แก๊ซ คัดแปลง เพื่อการค้า

ภาพข้อมูลดาวเทียม IKONOS ได้รับการสนับสนุนจาก Center of Remote Imaging, Sensing and Processing (CRISP) ที่ University of Singapore



## 1. Introduction: Sumatra Tsunami one of the most terrifying National Disaster

The 2004 Indian Ocean earthquake was more powerful than all of the world's quakes over the previous five years put together. It was the largest quake ever recorded and the biggest for four decades. It was so big that it actually shifted the planet, knocking it off balance and shortening that day by three-millionths of a second. The total energy of the tsunami waves has been calculated at around five megatons of TNT, which is more than twice the total explosive energy used during the whole of World War Two. Some witnesses said the approaching tsunami sounded like three freight trains or the roar of a jet; others were taken completely by surprise. (source: Geoff Tiballs, Tsunami 2005)



ตำแหน่งการเกิดแผ่นดินไหว Main Shock (9.0 Richter) และ After Shock 25 ครั้ง ในทะเลอันดามันและมหาสมุทรอินเดีย  
 ตั้งแต่ วันที่ 26 ธันวาคม พ.ศ. 2547 (เวลา 7.58 น.) ถึง วันที่ 27 ธันวาคม พ.ศ. 2547 (เวลา 13.59 น.)



แหล่งข้อมูลอ้างอิง : USGS Earthquake Hazard Program (<http://earthquake.usgs.gov/research/gw/>)

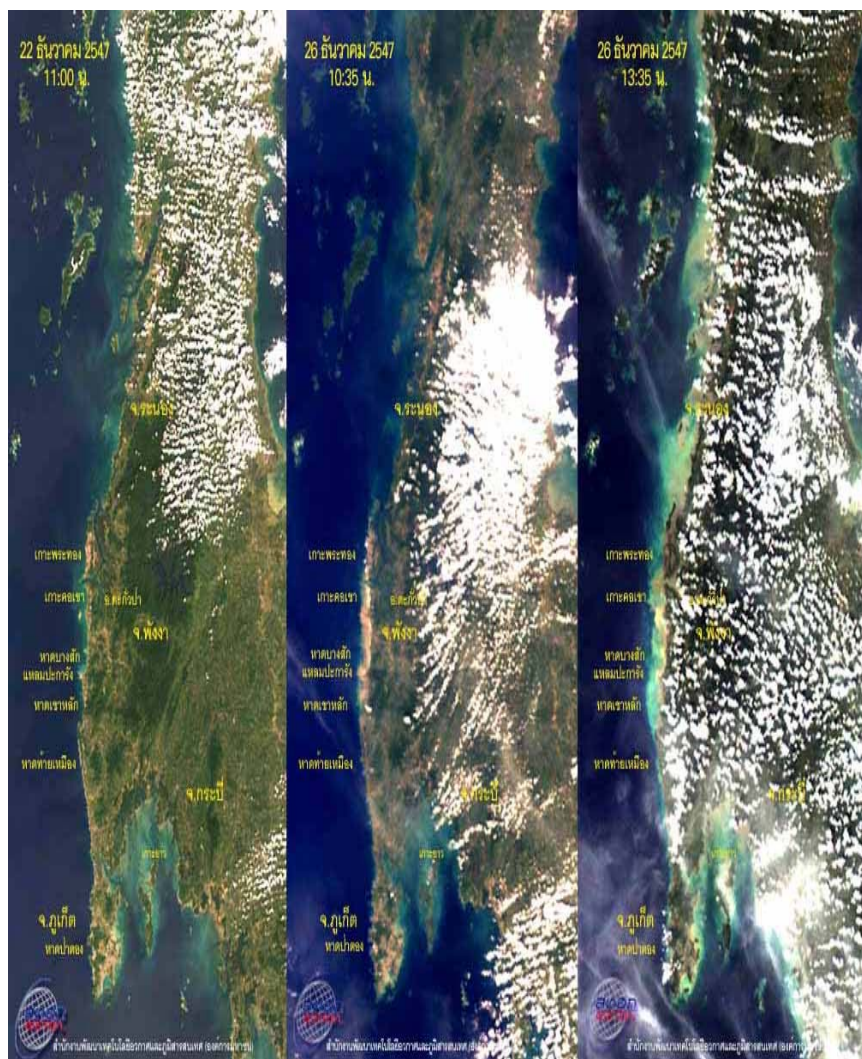
จัดทำโดย ฝ่ายยุทธศาสตร์การวิจัย สังคม วัฒนธรรม และสุขภาพ

ศูนย์วิจัยและจัดการความรู้เพื่อพัฒนาชนบท (GISTHA) [www.gisthai.org](http://www.gisthai.org) 27 ธันวาคม 2547

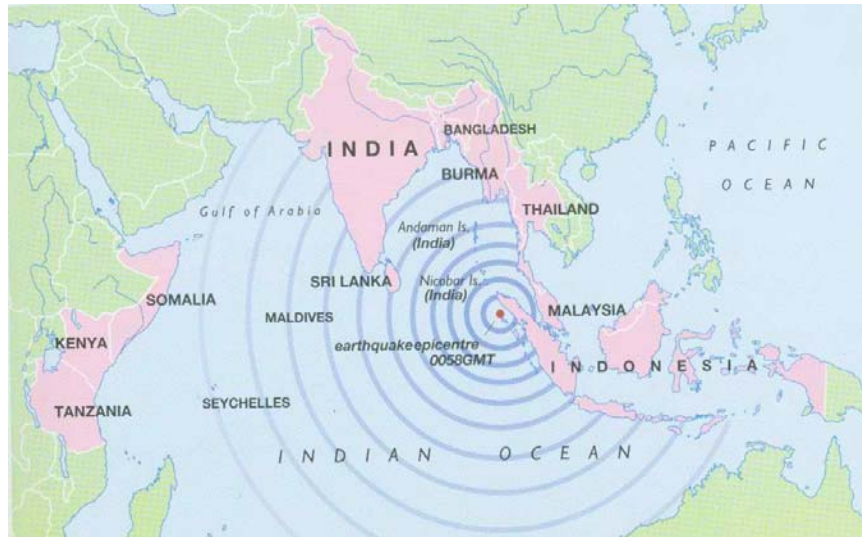
สงวนลิขสิทธิ์ หากมีคำซ้ำ ทำการคัดลอกส่วนหนึ่งส่วนใดโดยไม่ได้รับอนุญาต



Picture 1: Sumatra Earthquake 2004 which caused Tsunami , one of the Most terrifying Natural Disaster



Picture 2: The 2004 Indian Ocean Earthquake , the fifth largest quake ever recorded and the biggest for four decades.



Picture 3: The tsunami on 26 December, 2004 wreaked everything in its path over a seven hours period.



Picture 4: The total energy of the tsunami waves is more than twice the total explosive energy used during the whole of world war two.

## 2. Damage of Disaster on December, 2004

### *2.1 The Tsunami wrecked everything in its path over seven hours period*

In some places the waves reached a height of 15 metres (50 feet), but elsewhere witness described a rapid surging of the ocean, more like a powerful river than the advance and retreat of giant wave. The force of the waves snatched people out of sea, drowned them in their homes or on beaches, or crushed them by hurling them against structures. Snorkellers were dragged across coral reefs, divers were trapped in caves, and fishermen were carried out to sea, never to return. Up to a third of the people who died in the Indian Ocean tsunami were children, many of whom would not have been strong enough to resist the power of the water.

Even adults were simply not able to run away fast enough. Survivors said that the sea surged out as fast and as powerful as it came ashore with the result that many who had survived the incoming wall of water were seen being swept out to sea when the ocean retreated. Once caught in the torrents of raging waters, survival was down to pure chance. People who were together when the tsunami arrived were invariably separated. The fortunate ones managed to cling to buildings or trees; others were swept to their deaths. An eerier aspect of the disaster was that comparatively few people were injured. It was a case of death or survival.

Given the speed at which the tsunami spread, even an early warning system may not have saved the people of Sumatra. But it would be surely have preserved the lives of thousands who perished in other countries further along tsunami's path of terror. (source: Ibid)



Picture 5: The incredible of tsunami was felt in countries across the 4,500 kilometer- wide Indian Ocean.





Picture 6: The forces of waves snatched people out to the sea, drowned them in their homes or on beaches.

## ***2.2 Case of Thailand***

On December 26, 2004, there was an earthquake occurring to the North of Sumatra. Its intensity was 8.9 on the Richter Scale. This caused tsunami storming six provinces on the coast of Thailand on the Andaman Sea. The 6 provinces were Ranong, Pang-nga, Phuket, Krabi, Trang and Satul. The tsunami caused unprecedented damage to life and marine resources. The first four provinces were the hardest hit.

The areas damaged by tsunami can be classified into two categories: an area where residents are involved in tourism and an area where residents earn a living from natural resources such as being fishermen.

According to the study of photographs taken by IKONOS satellite and the aerial surveys of various agencies, the hardest-hit

areas were those where there were a lot of buildings especially, and other facilities. In addition, they were directly hit by the tsunami. Such areas were Takua Pa District in Pang-nga Province.

The Death toll in the six provinces was 5,390 and 3,570 were missing (Formal Data of September 9-11, 2005)



Picture 7: Hotels and Resorts in the 6 Provinces of Thailand were destroyed by Tsunami.



Picture 8: Both the area where residents are involved in tourism and the area where residents earn a living from natural resources were destroyed by Tsunami.

### 3. The Linkage of Destruction to National and Socio-economic Loss

#### 3.1 Economy

To assess the economic severity, the damage to ways to earn a living such as service provision, agriculture, fishery and livestock raising. It can be summarized that the areas which were severely damaged in terms of economy were tourism areas. These areas are renowned worldwide such as Takua Pa District, Kura Buri District and Tai Muang District in Pang-nga Province, Katu District in Phuket Province and Suk Samran Sub district in Ranong Province. Such areas are major tourist attractions generating a lot of income shown in their provincial gross product. Phuket in particular, was severely affected because its major source of income is from such tourist attractions in Katu District as Patong Beach and Kamala Beach. This District needs rapid recovery.



Picture 9: The tourism areas damaged by Tsunami need rapid recovery.

Table 1: Showing the Economic Loss Caused by Tsunami.

No.	Province	Death toll	The injured	The missing	Damage				
					Agriculture (bath)	Business (bath)	Fishery (bath)	Livestock (bath)	Public utility (bath)
1	Ranong	159	246	11	658,021	830,000	170,737,983	3,049,138	28,133,200
2	Rang-nga	4,195	5,597	1,835	2,485,293.75	6,211,253,000	913,549,111	13,660,585	424,064,162
3	Phuket	260	1,111	646	184,146	3,954,082,932	320,504,169	303,650	377,364,383
4	Krabi	693	1,376	706	342,900	2,683,651,780	191,696,510	325,240	212,917,203
5	Trang	5	112	1	3,545,000	2,800,000	14,980,000	43,392	4,276,620
6	Satun	6	15	0	1,165,000	0	119,393,730	243,600	7,100,000
<b>Total</b>		<b>5,318</b>	<b>8,457</b>	<b>3,199</b>	<b>8,380,360.75</b>	<b>12,852,617,712</b>	<b>1,730,861,458</b>	<b>17,625,605</b>	<b>1,053,855,568</b>

Source: Department of Disaster Prevention and Mitigation, Ministry of Interior 2005

### 3.2 Society / Social Loss

The areas which were severely affected in terms of society were those casualties were high including damage to housing and public building. Such areas included Takua Pa District, Kura Buri District and Tai Muang District in Pang-nga Province.



Picture 10: The damaged Area in Phang-nga Province

- Communities 8.01 %
- Agricultural 30.59 %
- Fresh water Area 6.77 %
- Others (beaches, mangroves, trees, old mining ponds, etc.) 54.63 %

Source: Land Development Department, Thailand





Picture 11: The wreckage in the communities.



Table 2: Showing the Total Damage to Life and Property Caused by Tsunami.

No.	Province	Death toll	The injured	The missing	Damage				
					Agriculture (baht)	Business (baht)	Fishery (baht)	Livestock (baht)	Public utility (baht)
1	Ranong	159	246	11	658,021	830,000	170,737,983	3,049,138	28,133,200
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Source: Department of Disaster Prevention and Mitigation, Ministry of Interior 2005

#### 4. The Rebuilding Operation: Drinking Water and Communities

##### 4.1 Assistance

1. From December 26, 2004 to March 2005, the corpses had been collected and identified. Rescuers were organized to search for survivors. Responsible agencies were mostly government agencies. They included the Royal Thai Army, Ministry of public Health and the Department of Border Patrol Police. Embassies and the private sector provided support in the form of vehicles transporting supplies and other necessities.

2. Donation of consuming items. This was done mostly by the private sector, individuals and international organizations.

3. Financial assistance was provided by various governments and Thai and foreign individuals.

4. As for public utilities, the government agencies and governments of other countries had been giving assistance in this matter since the first three months of the disaster. They drilled water ponds, provided necessary facilities, set up a public utility system in the new housing compounds for the homeless and arranged environmental sanitation such as provision of drinking and using water, disposal of contaminated wastes and rebuilding of infra structure.

5. With regard occupation, the government agencies provided jobs and job training, paid compensation to fishermen and funded small entrepreneurs.

6. As for health, most of the assistance were provided by the government agencies and private organizations. They provided medical care, contributed money for constructing community hospitals, offered medicine and medical equipment and gave health advice.

7. Most of the programs set up to rehabilitate the environment focused on repairing governmental facilities, building meteorological stations, setting up an electricity generating system by using solar power and improving wind detecting stations. The other sector or the private sector in conjunction with the government sector. The local people were encouraged to organize a group to carry out activities rehabilitating their environment.

8. In terms of education and family. Most of the assistance in this aspect was provided by private developing organizations and individuals as well as governments of other countries. The assistance was in the form of repairing schools, providing scholarship, arranging special tutoring, donating educational materials and toys, setting up a mobile library and rehabilitating children's mental state.

9. As for housing, compensation or houses were offered by both government and private sectors.



Picture 12: The Assistance was provided by the private sector, individuals and international organizations.

#### ***4.2 Situation of Drinking and Using Water***

There were no change in most sources, that is, both before and after the disaster, the local people prefer bottled water except in Hua Leam communities. The people here used to drink tap water before the disaster but after the disaster more people prefer bottled water. Regarding its quality is good. As for sources of using water, the communities in Tuk Kae Cape and Hua Leam have been using tap water both before and after the disaster while the communities in Nam Kem used water from shallow ponds and tap water. Most of the communities in Kamala have been using water from shallow ponds and the quality of the water has been good. When compared with the quality of water before the disaster, it is found that the quality of water after the disaster is better.

Table 3: Showing Sources and Quality of Drinking Water before and after the Disaster  
Based on the Studied Communities

Sources of Drinking Water	Tuk Kae Cape		Kamala		Nam Kem		Hua Leam	
	Before	After	Before	After	Before	After	Before	After
Shallow Ponds	0.0	0.0	0.0	3.3	1.7	0.8	3.2	3.2
Aquifers	0.0	0.0	3.3	0.0	0.0	2.5	0.0	0.0
Rainwater	25.0	15.0	3.3	0.0	0.0	1.7	12.9	3.2
Bottled Water	60.0	75.0	90.0	96.7	81.8	75.2	6.5	64.5
Tap Water	0.0	5.0	0.0	0.0	1.7	5.8	45.2	12.9
Rainwater and Bottled water	15.0	5.0	3.4	0.0	9.1	6.6	3.2	6.5
Others	0.0	0.0	0.0	0.0	5.7	4.1	25.8	9.7
Response not given	0.0	0.0	0.0	0.0	0.0	3.3	3.2	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Surveys

Table 4: Showing Sources and Quality of Using Water before and after the Disaster  
Based on the Studied Communities

Sources of Drinking Water	Tuk Kae Cape		Kamala		Nam Kem		Hua Leam	
	Before	After	Before	After	Before	After	Before	After
Shallow Ponds	5.0	0.0	66.7	66.7	36.4	5.8	22.6	16.1
Aquifers	0.0	0.0	10.0	10.0	2.5	4.1	0.0	6.5
Rainwater	10.0	0.0	0.0	0.0	0.8	1.7	0.0	3.2
Bottled Water	20.0	5.0	3.3	3.3	20.6	19.8	0.0	12.9
Tap Water	50.0	90.0	13.3	10.0	26.4	57.9	67.7	41.9
Rainwater and Bottled water	5.0	0.0	3.3	6.7	4.1	0.0	0.0	0.0
Others	10.0	5.0	3.4	3.3	9.2	9.9	6.5	16.2
Response not given	0.0	0.0	0.0	0.0	0.0	0.8	3.2	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Surveys

The water sources of the tsunami sufferers were shallow ponds, wells in old mines, aquifers, tap water, rainwater and bottled water. The last two kinds can be drunk without being processed while the others have to be processed before being drunk. Tap water is not generally used as drinking water. Bottled water is more preferable.

The amount of annual rainfall in the south of Thailand is high. The provinces on the Andaman Sea, in particular, receive 2,627 millimeters of rain yearly. As a result, they are known as cities of eight rainy seasons and four summers, that is, it rains for eight months and it does not for four months. Due to heavy rain, the South of Thailand has the tropical rain forest and its topography is good for rubber plantation. What's more, there is water in shallow ponds and wells in old mines all year round.



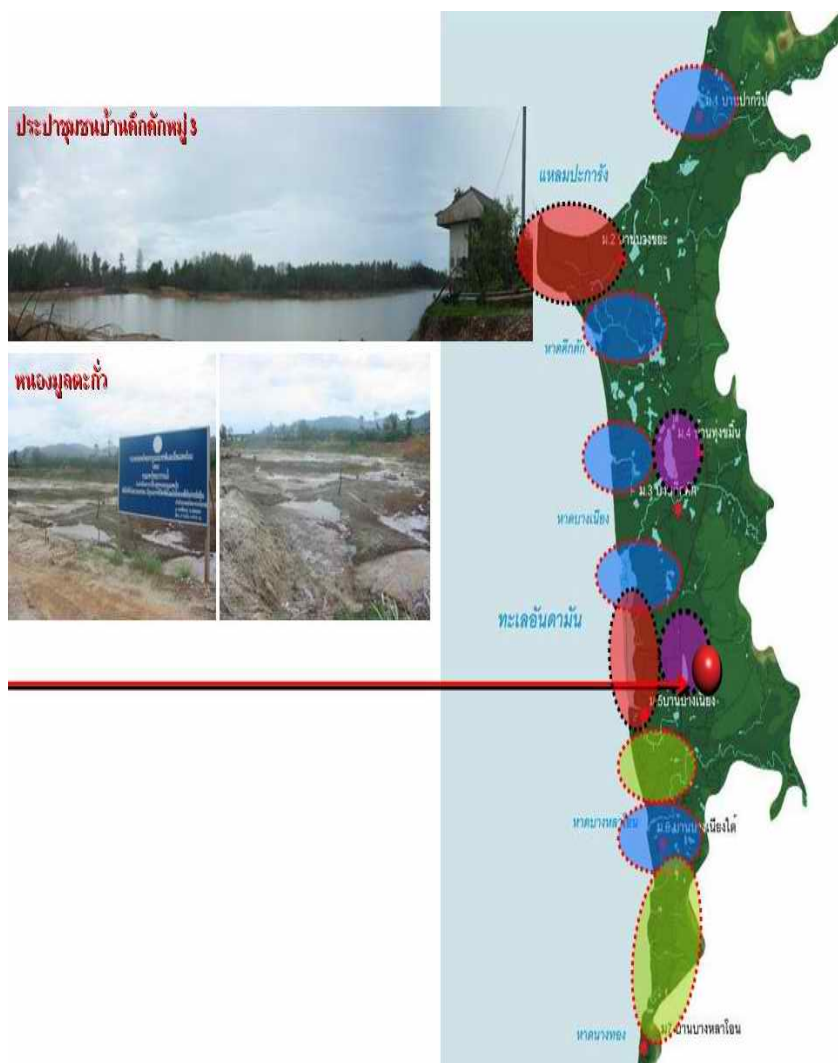
Picture 13: Aquifer, one of the most important water sources turned to be salty water.



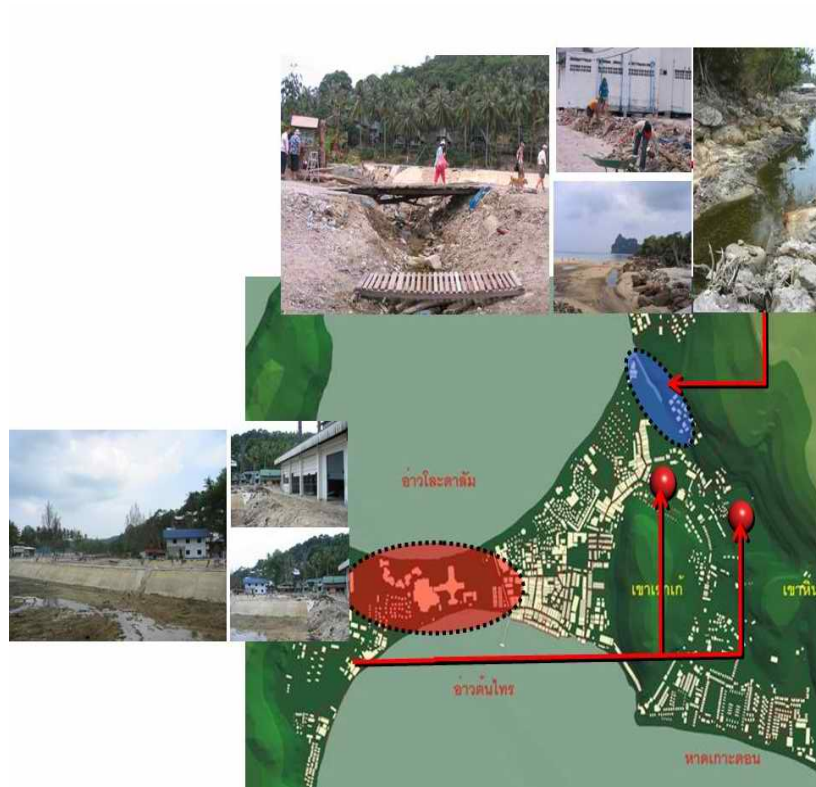
However, after the tsunami, it is found that the water in those natural sources turns to be salty water. According to the survey of scientists of Chulalongkorn University, the sea water has replaced the fresh water and the structure of the earth has changed. The coastal area has been collapsed, consequently, the sea water can seep into the aquifers. Thus, the water in the aquifers is not suitable for drinking.

It can be concluded that there are two factors leading to this change.

1. Natural Factor. The tsunami and the collapse of the coastal area result in the water in natural sources being more salty and contaminated with sand and debris.



Picture 14: After Tsunami Disaster, Salinity from sea water replaced the fresh water in the shallow ponds and even aquifers.



Picture 15: There were land sinking, resulted from the coastal erosion.  
Some aquifer holes were filled up.

2. Man-made or Human Factor. The construction of new buildings obstructs the flow of the water and some sewage contaminates the water in the natural sources.



Picture 16: The assistance from the government by many houses without the sewerage system also contaminated the fresh water ponds.

#### 5. Rehabilitation of Drinking Water for Community Revitalization

The revitalization of the community and its surroundings has to be done at the same time. The building of housing without taking community environment into consideration especially drinking water causes people in the community to have a hard life because they have to depend on the bottled water only. It costs more after the disaster but people earn less. Some are even unemployed. Provision of cheap or

free-of-charge drinking water for every household is a sustainable community revitalization. Rain water is an ideal source since it rains all year round and everyone can access to it.

As for Baan Nam Khem in Pang-nga Province, the community revitalization without taking consideration is classified as Human factor.



Picture 17: Tsunami people are poorer but they pay more for their drinking water. Rain water should be taken back for community rehabilitation.



Picture 18: Rain water belongs to everyone we should not prevent ourselves to access the rain water

## 6. Conclusion and Recommendation

Lack of drinking water should not be another burden for the communities and worsen the rehabilitation situation. Rainwater should be considered as the natural capital for the community development after the tsunami destruction. The blessing from the mother nature must not be paid and every human must have the equal accessibility to use it. Therefore the rainwater is social capital for the communities as well the challenging question for us is how to revitalize the rainwater to be the community drinking water. The answer is derived from the integration among local wisdom and the appropriate technology on the basis of people participation. Two principles need to be considered. They are:

1. Keeping the rainwater in the ground or in-land rainwater. That is the way to maintain the rainwater in the ponds, swamps or old-mining ponds as much as it could be before flowing away to the sea. The obstacles from construction must be solved. The waste water from the communities must be treated and the environmental plan of the communities must be implemented.

2. Keep the rainwater in the houses. The wisdom of Asian people to get water from the roofs through the traditional houses must be recalled more than that the traditional containers for example, jars

and buckets should be promoted to be used again. That is the way to bring the water back to the people to alleviate the tsunami disaster.



Picture 19: Keeping the rainwater in the ground or in-land rainwater.



Picture 20: Keeping the rainwater using houses' roofs.



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