

# Lessons for Tsunami: Staking Our Lives on Future Disaster Prevention

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**Abstract**—Japan is often referred to as one of the world’s worst seismically unstable countries. On March 11, 2011, a 9.0-magnitude earthquake struck off the northeastern coast of Japan. The quake launched massive tsunamis (enormous tidal waves), which inflicted unprecedented damage on the nation. Looking back on recent decades, innumerable people in various countries experienced severe natural disasters. There are many things we can learn from the real surviving cases of the past, as with state-of-the-art rescue technologies. The aim of my research is, for people who are living cheek by jowl with environmental dangers in the era of unstable weather conditions, to clarify some significant points: what to do to survive future crises. Regarding tremendous and irrevocable damage as results of natural disasters such as earthquakes and tsunamis, we must prepare for the impending catastrophe immediately.

**Keywords**—disaster prevention, Henry D. Thoreau, Tsunami, warning system

## I. INTRODUCTION

On a 1,300-year average, a huge tsunami hits Japan every seven years. According to some research, the official casualty toll from the Great East Japan Earthquake, (soon became known as “3.11”) was over 15,824. And the causes of death were classified as 92.4% by “drowning” [1].

Imagine you went fishing or swimming in the ocean with your family or friends. You may be playing with a beach ball or on surfboards. Where is your cell phone? Maybe the modern convenience is in your beach bag. You never realize when an earthquake happens while you are swimming. So you can’t get any information about your impending doom. Later on, you may watch the seawater begin to recede quickly. Some would be surprised with the unusual scenery of drying seabed. Then you suddenly notice a tremendous black wall is approaching you directly at tremendous velocity. It travels at the speed of a jet aircraft and the three to five-story high tsunami reaches more than 10 kilometers inland. This was what really happened in many coastal villages in Japan eight years ago.

The following motion picture from CBSNEWS.com shows you one of the most horrifying scenes of the day [2].

[https://www.youtube.com/watch?v=1ikus\\_TeAGI](https://www.youtube.com/watch?v=1ikus_TeAGI)

Furthermore, the next picture ([3]) reminds us of the simple

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fact that any man-made construction cannot be safe when it is hit by a big tsunami.



Fig. 1 A Photo taken at Onagawa, March 12, 2011

The cars and scraps were washed up on top of the buildings. We can not help feeling that human beings are extremely helpless in the face of destiny when we see the photo. But above all, the radiation leak from the Fukushima Daiichi nuclear plant caused the greatest anxiety to the people in the world. Remembering the ravages and lessons from the natural disaster and successive accidents can be a warning and protection against future major tsunamis for coming generation.

## II. EMERGENCY DRILLS FOR SURVIVAL

Human beings suffered 7 extremely large earthquakes since 1900 [4]. The frequency of disasters on a global scale in recent years urges us toward establishing some new cooperative perspective for international crisis management.

TABLE I  
LARGE EARTHQUAKES IN THE WORLD SINCE 1900

Date	Place	Magnitude
1960/5	Chile	9.5
1964/3	Alaska Bay	9.2
<b>2004/12</b>	<b>Sumatra, Indonesia</b>	<b>9.1</b>
<b>2011/3</b>	<b>Tohoku, Japan</b>	<b>9.0</b>
1952/12	Kamchatka Peninsula	9.0
2010/2	Chile	8.8
1906/2	Ecuador	8.8

In 2004, one of the great tsunamis killed more than 220 thousand people in Indonesia and nearby countries. Probably it was the deadliest disasters ever to have happened and recorded in the modern history. But we must remember that there is a small island called Simeulue in the Aceh province which lost only a few out of 78,000 islanders. This was because, from generation to generation, the islanders had passed down a significant lesson learned from the past tsunami they experienced a century earlier (in 1907). The lesson is that “if there happens an earthquake, and the sea water is receding from the shore, escape to the mountains.” The islanders made it a nursery song and a poem called “Nandon Summun” to memorize easily. After the huge earthquake, they immediately ran to a 30-meter-high hill and most of them were able to survive. Even today, the children of Simeulue Island often sing and dance according to this instructive song in their schools. This episode teaches us the effectiveness of education of disaster-readiness programs. On the same day, in Malaysia, some lifeguards on beaches in Penang used a simple red flag warning system, and they succeeded in reducing the number of dead people.

We see another case in Japan likewise. In Kamaishi City, more than 850 people died and about 450 people are still missing due to “3.11” tsunami. But only 5 of the casualties were elementary or junior high school students. The other 2,900 students reacted quickly and escaped safely. The high survival rate of the students was due to Kamaishi city’s disaster prevention education program, which was started a few years prior to the disaster. On the day of the tsunami, according to the instruction drills, the students spontaneously gathered on the school ground, and began running toward their evacuation site located high up on the hill. The junior high school students ran behind the elementary school children and supported them. Their schools were swallowed by the giant tsunami that struck about half an hour after the quake [5].

These episodes clearly indicate that every school and community should emulate such kind of traditional and essential evacuation plans or methods including mental and physical training.

### III. UNPRECEDENTED FIRE SIGNAL

Having lost all belongings and lifeline after an earthquake or tsunamis, many people would be unable to make any contact with others. Aftershocks often come one after another throughout the night, preventing the victims from getting any sleep and rest. However, if people were not alone, and if they survived with their family and friends, they might feel better. From this point of view, let us contemplate some communal ways to survive disasters.

Frequently (though not always), an earthquake may be an advance notice of the coming of a tsunami. In 1854 (165 years ago), a Japanese rich landowner, Hamaguchi Goryo, saved many lives of villagers when a huge tsunami devastatingly hit the Ansei-Nankai area in western Japan. The man knew the fact that the sea’s unusual withdrawal following an earthquake often signals a tsunami’s arrival. In Wakayama Prefecture, on November 5th, Goryo was standing on a hill. He noticed that the coastal water began to withdraw after a strong earthquake,

leaving the sea floor unusually exposed. He made a quick action. According to the folklore, Goryo set fire to his abundant rice harvest (piled up on top of a hill) to urge people toward a hilltop showing an evacuation route by the beacon fire. Finally, Goryo ignited his whole-year’s harvest in order to make the tsunami-warning fire signals, trying to evacuate his villagers. Many of them ran high up to the hill in a big hurry, and all of them were stunned at the sight of the tsunami swallowing their village. This is the summary of “Inamura-no-hi” or “the bonfire of rice sheaves.” Goryo’s feat impressed a famous novelist, Lafcadio Hearn, who wrote a novel named “A living God” and published it in 1897. The story was translated into Japanese later, and was used as a government-designated disaster prevention textbook for Japanese youngsters from 1937 to 1947. Even today, children can read his story in folklore and picture books.

### IV. SOLIDALITY OF COMMUNITY

After the Ansei-Nankai Disaster, Goryo played a very important role as a leader of reconstruction of the damaged village. He hired the tsunami victims to make a huge breakwater, 5 meters high & 600 meters long, to protect the village from the next tsunami. Actually, 92 years later, another tsunami attacked the same village, and Goryo’s defensive wall saved most of its residential area. Goryo invested his private capital in the public enterprise to strengthen the villagers’ love and solidarity to their hometown. In general, survivors must endure harder lives as the result of disasters, but they should try to share daily necessities and help each other. In Goryo’s case, his construction plan needed more than 4 years to be completed, and many villagers could live with the work. Goryo let them plant Japanese lacquer trees near the great wall, which benefitted the entire neighborhood, providing them with extra money because the protective trees, at the same time, produced some special glaze to cover and protect wooden bowls.



Fig. 2 Goryo’s Breakwater: Still Protecting the Villagers ([6])

If we lost most of our lifelines all at once, it would be necessary to stay connected with our neighbors, and to help each other. After the Great Hanshin Earthquake (January, 1995), hundreds of hand-written posters were often seen at each evacuation center, under the eaves, or on the gates of shattered houses with a message such as “A is OK” or “B is staying at C”.

Such primitive means of communication proved most effective for the victims lived in the quake-affected area and for the people who hurriedly visited the place after the quake. Azefu insists that word-of-mouth communication was the most effective and widely used at that time by showing us a photo below [7].



Fig. 3 At an Evacuation Center (A Primary School) in Kobe-city

Getting actively involved in the local community in your daily lives becomes more important than ever. The community which can easily take communication on a daily basis could raise not only good children but also a good future leader like Goryo among them.

Also, by learning from the tragedies of our past, we should put our efforts toward maintaining a cooperative spirit internationally. After the “3.11,” lots of volunteers came from other areas and from many countries. For example, Ohio University students came from the United States soon to help Japanese victims regardless of the chaotic situation in radiation leak. Also, in the wake of the disaster, many countries offered heart-warming support to the Japanese. As Suzuki said, “The best way to communicate may be just to sit without saying anything. Then you will have the full meaning of Zen” [8]. Volunteers and relief supplies from all over the world rushed to the stricken area. Many Japanese felt profoundly grateful for it, and the victims might not forget the kindness and braveness of the supporters forever.

V. CATCHING ATTENTION

Now let us listen to a voice from the past—the voice of Henry David Thoreau, who was a very famous American naturalist in the 19th century. Thoreau gave us a useful hint for evacuation. As a pioneer with the leading awareness of the need for sustainability in the environment, he built a small, recycled log cabin near Walden Pond by himself. He tried to live as self-sufficiently as possible. One day, however, he burnt a forest mistakenly by his campfire. The fire spread so quickly that he could do nothing but let it go. Later, Thoreau wrote about the traumatic incident in his canonical book, *Walden*. He said that if he pulled the bell rope of a church, all men and women would get together for the warning. While the fire alert could not be seen well in the daylight, the bell sounds could be heard by “a man on his farm in the outskirts of his town, Concord” [9]. He actually rang the church bell by himself to gather audiences for

some special occasions. He taught us how to use the power of sound as an effective alert against crises. Coincidentally, the book, *Walden* was published in 1854, the same year as the Ansei-Nankai Earthquake.

Nowadays, in addition to the traditional warning sounds, the buzz of cell phones plays a significant role for spreading urgent information. Even in “3.11” and the following nightmarish days without television or radio, people who could use smartphones and personal computers were tweeting and waiting for updating of the internet. Not a few TV watchers in Japan pointed their cell phones at TVs and began live streaming the news. The pictures of the disaster started to leak out one after another online. Some bloggers opened disaster information pages that were proved to be truly useful to many people.

If somebody can luckily keep his/her smartphone through a disaster, the person should be a messenger of the up-to-the-minute news to the neighbors, like Henry Thoreau who rang the warning bell as a leader of the small society. As long as people try to help each other, a new, strong community is spontaneously formed: the community of “all for one and one and one for all.”

VI. CONSIDERING OUR ENERGY SYSTEM

Apparently, “3.11” is the biggest crisis that Japan has faced after the defeat of World War II. It is officially said that the overall cost of the disaster is 16.9 trillion yen. However, according to Samuels, the world’s most famous rating company (Standard & Poor’s) “estimated that the cost would be 20-50 trillion yen and the number of foreign visitors to Japan fell 24 % in 2011” [10]. Also, Samuels points out that “fully one-fourth of Tokyo’s foreign residents returned home” [11]. In 2012, more than 117 thousand refugees had to stay in temporary rescue houses, or many were forced to leave their hometown after “3.11.” A newspaper article says that the cost just for safety recovery after “3.11” is “over 5 trillion yen” [12]. Before “3.11” there were about 440 operating nuclear reactors across the world, generating world’s 14 % electricity. The United States alone had 104 (out of 440). China, South Korea, India and other countries plan to build dozens more nuclear reactors [13]. At least it is clear that the “3.11” disaster demolished the myth that atomic power is safe and worthy in addition to its low cost.

TABLE II  
CHART OF JAPANESE POWER DISTRIBUTION

Fuel	Power generation	Current generation	Useful life	Building cost	Maximam Utilization	CO <sub>2</sub> Emission
Unit	TWh	Yen/kWh	years	Yen/kW	%	CO <sub>2</sub> -eg./kWh
Coal	24%	6~7.6	30~40	336	85	975.2
LNG	28%	8.4~10.1	30~40	222	68	607.6
Nuclear	28%	5.1~7.4	40~60	368	90	22.1
Oil	10%	9~15	30~40	387	55	742.1
Hydro	8%	8~13	80+	690	85	11.3
Geo-thermal	0.30%	8~22	20~30	340	85	15
Wind	Intermittent	10~15	20	300	30	29.5
Solar	Intermittent	30~58.7	20	300	15	53.4

This chart [14] indicates that on the eve of “3.11,” Japan seemed to have a well-balanced fuel mix. But by and after the accident, the domestic energy system changed drastically. In 2017, Japan uses only 2.8% of nuclear power of the total energy, and in 2019, the electric company decided to shut down Fukushima Daiichi nuclear plant forever. Germany, Italy and Switzerland have decided to stop making nuclear power plants any more. In the future, we hope that renewable and clean energy power sources will supply the bulk of our electricity.

Probably, the most important thing for us to do right now is to try to save energy as much as possible. The more consumers get accustomed to the daily convenience, the more they need energy and resources. As Henry Thoreau, let us live a simple life. If everyone manages to reduce personal energy consumption, we will be able to reduce all kinds of accidental risks for the next generation, and for the people you love.

## VII. SUGGESTIONS FOR FUTURE

In this paper, we have mainly examined the effectiveness of primitive warning methods through several disasters. Finally, let us summarize each section and offer useful suggestions in 6 points.

(1) Fire, lights, beacons and smoke signals should be prepared on top of the hills of towns for emergency. Flashy fireworks can also be effective as an emergency warning.

(2) Shelters serving both as observation towers and signal-sending offices should be provided in each waterfront community. Also, stairs and rooftops on tall buildings should be opened to all refugees in case of an emergency. Like tree-houses, every community should preserve enough emergency goods, rescue kits, dried food and water at higher, safer locations. Of course, everyone should have enough stocks for emergency supplies individually.

(3) Evacuation routes should be clearly shown to both local residents and visitors by huge, eye-catching direction signboards and in hazard maps. Singing, dancing, and chanting a rescue poem proved to be very effective methods for survival education. Traditional warning methods, such as emergency red flags should be set for all beaches.

(4) All community centers and public halls should be equipped with sirens, bells, microphones, and cars, drones and helicopters mounted with loudspeakers to warn people. Even when you are naked at the beach, you can hear loud or sharp sounds of whistles, bells and sirens.

(5) Keep strengthening bonds between your neighbors, community members and peers. Online networks will provide you with useful information. Disaster information that is factually correct should be shared by people as soon as possible.

(6) Although an individual's ability and strength is limited in a storm, we should unite with others tightly not to be blown away. While doing so, let us try to live independently and deliberately, keeping minimal lives for saving energy in our daily lives.

In order to survive whatever happens, let us prepare for the next disaster during normal times. The normal times—your ordinary daily lives free from disasters—might be shorter than you expect.

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