

**The role of forests in the Great East Japan Earthquake and sustainable forest  
management and its usage**

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Japan is an island country which is a part of monsoon Asia and is formed on plate boundary/ subduction zone. Therefore, Japan suffers from many natural disasters due to typhoons and front activities, such as heavy rain, earthquake and volcanic activities. (This nature is seen in many parts of Asian region) From the past, Japanese have been developing our society while overcoming natural disasters.

As a result, even when Japan was stricken by an earthquake of magnitude 9.0 on March 11<sup>th</sup> 2011, big cities such as Sendai, although experienced a seismic scale of 6 or over, were able to avoid many buildings from collapsing and helped minimize number of victims. From this result, it seemed that Japan's ability of seismic design method was proven very advanced.

However, the tsunami which occurred after the earthquake easily washed away the world largest break water facility and tide barrier and entirely destroyed the coastal cities and forests. Also with an unexpected nuclear power plant accident, Japanese people are again to face another issue of natural disaster. The Japanese once believed that "natural disasters are preventable by technology" and this was considered as "disaster prevention". However they were proven wrong after the recent earthquake. Now, Japanese are placed to shift their idea of "disaster prevention" to "disaster mitigation". They learned that "damages from natural disasters could be decreased, however not prevented entirely".

Facing this large scale tsunami, wooden houses and coastal forests seemed vulnerable. However, in this tsunami even 3<sup>rd</sup> and 4<sup>th</sup> floor of concrete buildings were also destroyed. After this disaster, victims who lost their houses say that although they wish to live in a safe and reliable home, they prefer to "live in a wooden house".

To add more, residents who live distant from the coast and were not affected by the tsunami say that, because the coastal forests have been destroyed they are now facing salt damages from the sea breeze. Even those residents wish the coastal forest to be recovered immediately. (However, the residents who maintained and conserved the coastal forest no

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longer live near the coast.)

According to an investigation after the disaster, it became evident that coastal forests were affected by the tsunami in the next following ways: 1)the stem of matured forest trees have broken and washed out; 2)young forests have been pushed over; 3) trees planted on ground with high groundwater level have been uprooted and washed away. Not only humans, forests as living thing have also become the victims of the vast external force of this disaster.

Yet, although coastal forests have become victims, they helped to: 1)reduce the power of tsunami; 2) slow the speed of tsunami to arrive on land; 3)capture driftage and contributed to weakening the disaster. Further investigation revealed that, coastal forests are effective to certain extent against waves less than 6 meters and significantly effective for those waves which are 3 meters and below.

From this result, coastal forests are now listed as one of the multiple protections against tsunami by the government at the reconstruction design council in response to the Great East Japan Earthquake. Hence, coastal forests will have an important role in the future tsunami prevention measures. From this reason, it is important to grow strong coastal forests with wide stand.

The coastal forests of Honshu, Shikoku and Kyushu are mostly pine forests (mainly black pine). These forests are identified as “protection forest” such as for wind break, fog prevention, tide water prevention and shifting sand control. They are artificial forests and were planted mainly to prevent damages from sand shifts after the 17<sup>th</sup> century. However, nowadays in Japan there are not many damages caused by sand shifts, and why is that? To answer this question, it is necessary to explain the situation of Japan back in the 17<sup>th</sup> century.

Sand shift is, sand blown by the strong wind of the sea which then cause damages to those people living along the coast. And the sand of the coast is mainly consisted of debris originated in the mountains. The debris is then transported to the river and to the sea. Therefore, it means that, in the 17<sup>th</sup> century, Japan heavily yielded debris and sediments within the mountainous districts.

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The Japanese are known to rely on rice cultivation. At that period, rice cultivation was heavily supported by trees, leaves, fallen leaves and water from the SATOYAMA (community forests grown on hilly and low mountain regions). Since the ancient times, Japan considered forests as an important resource. Between 16<sup>th</sup> and 17<sup>th</sup> century, there was development in farmlands and this led to improvements in agriculture ability and population increase.

In this circumstance, in the 17<sup>th</sup> century, forests of SATOYAMA were being deteriorated and many became bare land with no trees. Over usage of forests leads to land depredation. (This situation continued until half a century ago, and this can be seen on old photographs and UKIYO-E, a school of Japanese art depicting subjects from everyday life, dominant in the 17<sup>th</sup> to 19<sup>th</sup> centuries. In these art works, we are able to recognize that, the same views of deteriorated mountains that can be seen in the several developing countries of today. ) As a result, there were frequent segment disasters such as landslides and debris flows in the mountainous districts, flooding in the plains and sand shift damages on the coasts.

The feudal government of the Edo period (from 1603 to 1868), the central government at that time, and the local government "han", believed in the idea of "forest and water conservation". According to that belief the government ordered for land conservation project to commence and restricted activities such as harvesting and river improvements and suggested people to plant more trees. On coast lands, people planted trees to construct coastal forests which aimed to prevent damages from sand shifts. And the only canopy tree, which was able to grow on sand dunes of coast land was the black pine.

Later as the coastal forests grew stronger, they played the past role of satoyama. Since then, Japanese people considered the coastal forests as disaster prevention forest and community forest and have been managing and conserving them. Nowadays, coastal forests are not only for preventing and mitigating disasters but they also have many kinds of functions. They are now available for its beautiful landscape and recreational use. And they also help to sustain the coastal ecological system.

Deterioration of national land of Japan still continued until the start of Meiji era even

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after the end of Samurai era. The Meiji government enacted Forest Law (original), River Law (original) and Sabo (erosion and sediment control) Law, and promoted modernization of national land conservation. Under the Forest Law, the government commenced the protection forest system in which forests are designated to protect for flood alleviation, slope failure preventing etc. Furthermore, since 1911, “forest conservation projects”, which aims to recover deteriorated forests and prevent sediment disasters, have been conducted systematically. (Last year, 2011, was the 100<sup>th</sup> anniversary for “forest conservation projects”)

However, with the influence of the world war, problems of forest deterioration were unresolved. Even after the Second World War, over felling continued for post war recovery and economic developments. Due to this, there were frequent flooding and sediment related disasters.

The result of forest/ water conservation plan, which originally started in the Edo period, was not achieved until Japan had made economic and technology developments in the 1960s. Also at the same time, industries began to rely on chemical fertilizers and fossil fuels. These remarkable changes led agricultural industries to stop relying on forests. Entering into the 21<sup>st</sup> century, the forests of Japan have recovered. After half a century, Japan finally succeeded in halting the era of deterioration of forests, which continued over the past 400 years.

There are two types of slope failures which occur in mountainous district: 1) Debris slide (surface failure) occurs when weathered top layer break away; 2) bed rock slide (deep-seated failure) occurs when the bed rock collapses.

Sound forests prevent debris slides by the root system. (Debris slides may trigger debris flows and cause damages. Therefore, if debris slides are prevented it will also reduce the damage of debris flows) However, it is difficult to prevent bed rock slides. To add more, floor vegetation and litter of forests prevent surface erosions.

In Japan, due to forest recovery there have been decline in surface erosions and a dramatic decrease in debris slides. Hence, sediment transport from the mountains has reduced. As a result, sand being discharged to the sea has decreased and sand shift damages on the coast were also reduced.

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Forests also control floods, cultivate water resource and maintain water in good quality. Furthermore, if forests are well constructed, it will prevent avalanches in the mountains, weaken power of strong winds in the plain lands, prevent noise in urban areas and form beautiful landscapes. (I have already mentioned that coastal forest is effective for preventing strong winds, high tide waves and salt damages) Thus, natural disaster prevention forests and amenity forests play a very important role.

In 2001, the government reviewed the Forestry Basic Law which supported the economic growth of Japan then started to enforce Forest and Forestry Basic Law so that the main objective of forest management will be to sustain and strengthen the multiple functions of forest. The law responds to the voice of Japanese people and mainly focuses on disaster prevention and water conservation, as well as prevention of global warming and conservation of biodiversity.

In the same year, the Science Council of Japan submitted a report on multiple functions of forest requested by the Minister of Agriculture, Forestry and Fisheries. (In this report, multiple functions of forests are classified into 8 functions and explained respectively). In this report, it discusses on the “principles of forest” and its relationship between human and forests. The three principles of forest are that strong forests: ①) support the local/global environment which is the core of Japanese people (environment principle); 2) develop the spiritual and cultural mind of Japanese people (cultural principle); 3) offer resource materials such as timber (material use principle).

These principles are the same as regulating services, cultural services and provisioning services of ecosystem services, which was presented in the United Nations Millennium Eco system Assessment in 2003. Sustainable forest management and its usage will function, when all multiple functions of forests perform in a comprehensive manner. Hence, all three principles are required to be fulfilled. (The difference between ecosystem services and principles of forest are as follows. The ecosystem services are considered that humans are those who receive the services and ecosystem is to provide the service. Humans and ecosystem are confrontational to each other. On the other hand, principles of forest are recognized that forest and humans are elements equally composing the region/global environment.)

This year is the 20<sup>th</sup> year since the United Nation Conference on Environment and

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Development (UNCED) in Rio de Janeiro (also known as the Earth Summit) was held in 1992. It is in my belief that, Japanese are responsible for properly managing the artificial forests and enhancing the ability to absorb carbon dioxide. And to add more, we must cautiously manage the precious forests of Japan while they are listed down as one of the biodiversity hot spots.

Moreover, to make effective use of the forests, it is essential for the forestry industry of Japan to be revitalized. In Japan timber trade was liberalized approximately 30 years ago. Since then, Japan has heavily relied on imported timber and led forest industry of Japan to collapse and ruin the supply chain of timber. In order to cope with this situation, in 2009, the government formulated Forest and Forestry Revitalization Plan, which aimed to recover self-sufficiency ratio of wood products in Japan. I hope to see development of Japan's forestry and wood industry.

It is obvious that our biggest challenge is to recover from Great East Japan Earthquake. In the affected areas, they have already commenced building new towns and villages. Safety is the first priority, however, I do not agree with constructing high tide barriers in every coast.

Originally, in the coastal areas there have always being the risk of tsunami, high tide waves, flooding and salt damages. In the past, people avoided living in these dangerous coastal areas and preferred to live more inland. However, we constructed wharfs and cities on the coast for economic growth. In Japan it is natural for coast lands to be prone to struck by tsunamis. Therefore, for the coastal areas, I believe it is essential to develop land use plan considering natural environment. From the perspective of conserving the biodiversity, it is important to preserve the natural ecosystem. High tide barrier disturbs marine turtle breeding. Only by this example, it is not wise to separate the chain of land and the sea. In the main land of Japan, black pine trees of coastal forests are playing the role of mangroves in the tropics.

Instead of building concrete tide barriers, I find it important to seriously consider constructing new artificial sand dunes and recovering the coastal forests. Yet, recovery and strengthening of the coastal forests should be done cooperatively by the people and the governments of that region, volunteer groups and everyone in Japan and around the world.

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In an era of transforming toward low carbon society, construction made mainly by iron and concrete is inappropriate. Especially, while the northern district of Japan has been maintaining the Japanese tradition, it is necessary to rebuild wooden houses for them. Japanese timbers are traditional Japanese material and are carbon neutral. They are considered as eco friendly material and free from the risk of sick house syndrome.

To add more, immediately after the earthquake, there were lasting shortages in supply of electricity, gas and oil. This situation distressed those displaced victims. From this tragedy, we learned that keeping fuel wood and charcoal is very effective in these situation. Also, timber is suitable for architectural material and engineering material. Therefore, I believe timber should be stored in future so that it may be used as emergency material. And we should consider storing more wooden temporary houses making people feel the warmth of wood in the aged society.

My lecture ends here. Thank you for your attention.