ERIA Discussion Paper Series

Towards Reframing the Spirit of ASEAN Environmentalism: Insights from Japan's COHHO Experience and Studies

Masaru TANAKA[*†]

Moune Institute for Forest-Sato-Sea Studies

Shigeatsu HATAKEYAMA

NPO Mori wa Umi no Koibito

February 2016

Abstract: *Japan has managed to keep 67 percent of its forest area over the last half century. However, fishermen and the scientific community noticed a gradual breakdown in the fundamentally important ecological link between its forests and surrounding seas. In response, the Kyoto University established the Field Science Education and Research Center, which initiated the Forest–Sato–Sea studies on the interdependence of forest and sea ecosystems. Simultaneously, a grassroots movement of coastal fishermen—'The Sea is Longing for the Forest'—had started to develop. With heightened awareness of environmental problems resulting from the massive earthquake, tsunami, and nuclear accident of 2011, the movement and the people behind the studies have closely collaborated, convinced that fundamental solutions to environmental problems will require environmental education for the next generation—one rooted in real-life experiences. Such experiences can be gained by studying and working to restore the interdependence among forests, seas, rivers, and wetland habitats that connect them. To this end, it is hoped that an ASEAN Center for Forest/Sea Studies will be established, affirming ASEAN's commitment to collaboratively creating a sustainable future by balancing economic prosperity with environment conservation.*

Keywords: environment, forest, sea, ecosystem

[*] Mr. Tanaka is director of Moune Institute for Forest-Sato-Sea Studies, and professor emeritus at the Kyoto University; while Mr. Hatakeyama is director of NPO Mori wa Umi no Koibito—'The Sea is Longing for the Forest', and is guest professor at the Kyoto University.

[†] The authors are sincerely grateful to President Hidetoshi Nishimura, Dr Ponciano S. Intal, Jr., Dr Rully Prasetya, Chief Operating Officer Yasushi Iwata, and all of the Economic Research Institute for ASEAN and East Asia for providing the chance to have this paper submitted and discussed at ERIA. We also appreciate the support of Dr John S. Burke of the NOAA Southeast Fisheries Science Center Beaufort Laboratory, Prof Yuichi Kubota of the University of Minnesota, and Mr Deep Macmillan for their useful suggestions in improving this paper.

1. Introduction

The human population is already over seven billion people and increasing, along with environmental problems that threaten the sustainability of the world (Suzuki, 2010). The Association of Southeast Asian Nations (ASEAN) consists of 10 nations ranging in development from metropolitan countries like Singapore to countries where agriculture, forestry, and fisheries remain a dominant source of employment and substantial contributor to GDP (Intal, et al., 2011).

These primary industries that sustain a significant number of ASEAN societies are supported by rich water circulation between ocean and land. However, pressure from a rapidly expanding population threatens the environment that underlies these primary industries and raises fundamental concerns on the sustainability of the ASEAN societies' way of life. If ASEAN member countries decide to work together on environmental conservation for the region, a holistic concept that can act as a unifying force will be required.

The development of new and resurgence of old ideas in Japan in recent years have provided the idea for such a holistic concept. Although it enjoys primarily a temperate climate, the Japanese archipelago shares many environmental and ecological features of the tropical ASEAN member countries. An important feature of the region is the monsoon and the metrological advantage of rich precipitation. Its location near the Pacific Rim Ring of Fire is also significant, resulting in the development of unique cultures that can respond flexibly to the region's fluctuating nature (Oike, 2011). These similarities suggest that it is possible to collaborate on finding a way towards a more sustainable society for future generations.

Japan is rich in both forest and ocean and has in some ways maintained the earth's original nature. Originally, the earth was characterised by forest and ocean biospheres, connected by water circulation. The earth's land was originally 80 percent forest, but coverage decreased to 50 percent in 1700, and to 30 percent in 2010. Japan's many mountains are covered with deep, temperate forest. The coverage is 67 percent, which is almost equivalent to the forest coverage of Scandinavian nations. Approximately 35,000 streams run from Japan's mountains to its complex coastlines on the Pacific Ocean and the Sea of Japan. Japan ranks sixth in terms of total coastline, exceeding

29,000 kilometres (km) in total, and spanning subarctic to subtropical zones. These streams and resulting rivers provide fresh water to coastal areas, resulting in high biological production (Hatakeyama, 2003).

Traditional Japanese wisdom speaks of the existence of fish-breeding forests, the idea that the forest along the sea coast enhances marine organisms and sustains coastal fisheries. While Japan has maintained its forest coverage, it has drastically modified its rivers, streams, and coastline—changing the natural recirculation of water and undermining the basis for high coastal productivity. This was recognised by coastal fishermen who started a grassroots movement they called 'The Sea is Longing for the Forest', in recognition of the intimate link between forests and ocean. The founder of this movement is an oyster-culture fisherman, and the co-author of this paper (Hatakeyama, 2006). As this movement evolved, it stimulated studies on the connectivity of hills, humans, and oceans—the Connectivity of Hills, Humans and Oceans (CoHHO) Studies—aiming to reconstruct the connectivity of forest and ocean by means of rebuilding a sense of value for environmentalism (Tanaka, 2008; Kyoto University Field Science Education and Research Center, 2011; Shimizu et al., 2014). The urgency of this work increased with the disaster caused by the Great East Japan Earthquake of 2011. This paper aims to describe the development of social and academic responses to the recent environmental problems in Japan in the hope that they prove useful to ASEAN member countries in their own struggles to foster sustainable societies.

2. Birth of a Grassroots Movement

In 1989, a Japanese fisherman named Hatakeyama who specialised in oyster culture initiated a social movement named 'The Sea is Longing for the Forest'. He recognised that Japan's economic policy caused pollution not only in urban areas but also in the country's rural areas where culture fishery for oyster, scallop, and edible seaweeds is the basic industry. Led by Hatakeyama, fishermen insisted to the local government that culture fisheries could not continue without environmental improvement in forest, agricultural, and city areas. Due to the poor understanding of the linkage between terrestrial and marine environments at that time, their pleas went

unheeded. The fishermen decided to appeal to the public to plant trees in a mountain area from which water flowed to the coastal areas of the fishing and culture grounds—and the first tree-planting festival was conducted. Simultaneously, a similar tree-planting movement was initiated by a women's group of the Hokkaido Fisheries Cooperative Association to aid in the recovery of a Pacific herring population that had collapsed due to heavy logging, resulting erosion, and destruction of seaweed spawning beds of herring. To date, this tree-planting activity continues to be undertaken (Tamura, 2014). The tree-planting movement was further accelerated when fishermen worked with communities that were dependent on forest resources and forest-related industries.

Hatakeyama's belief and assessment—that water originating from the forest transported some elements that enhanced the production of phytoplankton, the food of oysters—is supported by some recent understanding of the role of iron in ocean productivity. Dissolved iron takes an important role in primary production; phytoplankton demands light, water, carbon dioxide, and nutrients for photosynthesis, but even under enough amount of nutrients, photosynthesis could not be accelerated. Although nitrogen and phosphorus are abundant in Antarctic Sea, primary production remains relatively at a low level due to low iron concentration. Martin and Fitzwater (1988) suggested that iron has an essential role when phytoplankton incorporates nutrients from the ambient seawater. The major source of iron is terrestrial ecosystem, like forest and wetlands, which Antarctica lacks. Water vapour that evaporates from the sea surface precipitates as rain or snow on the land to nurture forest. The leaves of deciduous trees are decomposed by insects and bacteria to form hummus in which dissolved iron combines with organic acids under anaerobic condition. Transported by rivers and groundwater to the coastal ocean, these iron compounds stimulate primary production. The importance of iron was further supported by the publication of the book *The Sea Grows Inanimate when the Forest Disappeared* (Matsunaga, 1993). An evaluation of the extent of forest contribution to oyster production indicated that iron-enriched water caused 80 percent increase in the culture production in Kesennuma Bay. The result highly encouraged the fishermen and it motivated their continuing practice of tree-planting activities.

The grassroots movement initiated three major activities—forest restoration, nature conservation, and environmental education for children. After the disastrous earthquake in 2011, a fourth was added—creating a sustainable community. Of these activities, environmental education through outdoor activities particularly for schoolchildren was the highlighted activity. Hatakeyama, the movement's leader, expressed his environmental advocacy as 'planting tree in children's hearts' and invited many students to his oyster farm to see oyster culture and to introduce and explain the intimate relationship between land and sea. The number of students participating in these farm visits now exceeds 10,000 over the last 20 years. As a result, students started to realise the harm in the use of harmful chemicals and asked their parents to reduce their use of such chemicals. Behavioural changes amongst the children relative to the environment helped influence their parents, resulting in improvement in the local government environmental policy. Today, these schoolchildren who were earlier educated in the oyster farm by the movement are now adults, and are now raising their own children with a strong sense of the environment.

These social activities caught the attention of the Japanese government and have been highly regarded for their importance to the country. As a result, the concept and practical activities of 'The Sea is Longing for the Forest' were introduced to students from elementary to university levels. In 2004, Hatakeyama was invited to the Kyoto University as a guest professor with the objective of connecting society and the academe. Although the movement was temporarily hindered by the 2011 earthquake, it survived and later grew, attracting many supporters—both in Japan and from other countries (Tanaka, 2014). Just three months after the 2011 disaster, the 23rd annual tree-planting festival was successfully conducted. After 25 years, the movement has been broadly accepted and the success story of 'The Sea is Longing for the Forest" is told in an English textbook for high school students in Japan. The world is also beginning to pay attention to this idea and Hatakeyama was recognised as a forest hero by the United Nations in 2012. This was followed by a nomination to The Earth Hall of Fame Kyoto in 2014. These recognitions confirm that the concept of 'The Sea is Longing for the Forest' has been getting widespread attention—from Japan to the rest of the world—in recent years.

3. Academic Studies on the Connectivity of Forests and the Sea

Scientific studies in Japan have revealed many compelling examples of the importance of the connection between forests and the sea in terms of coastal fishery productivity. Important fish and fisheries that depend on these degraded connections are in various stages of depletion and these include the Japanese eel (considered critically endangered), Japanese flounder, salmon, Manila clam, *asari* clam, and all harvested stocks except jellyfish in the Ariake Sea. In response to these stock depletion problems, the Kyoto University reorganised in the late 1990s the life sciences to more effectively address global environmental issues. The Field Science Education and Research Center (FSERC) was established by integrating experimental forest, fisheries station, and marine laboratory that belonged to different faculties to focus research on forest and marine studies (Tanaka, 2008; Kyoto University FSERC, 2011). The unifying concept was the connectivity between forest and sea, which differed from previous watershed approaches by focusing on 'Sato' (human habitation) and its impact on the relationships between forest and sea. Thus, these studies differed from previous natural science approaches—the social and cultural sciences are included here as these were directly influenced by 'The Sea is Longing for the Forest' movement, while integrated studies starting from the headwater to the ocean was proposed in 2003 by the Kyoto University. The studies aimed to highlight the connectivity between neighbouring ecosystems and intervening human activities. The goal is to restore the essential connectivity that was cut by human activities primarily by rebuilding people's sense of environment and by changing human attitudes. Many Asian students joined the programme.

If the newly established studies on the ocean–forest connectivity are to improve this situation, they have two major tasks: one is to integrate the different scientific fields within the academic field; the other is to foster collaboration between society and academic studies. The first task has been conducted mainly in Kyoto University's FSERC where CoHHO stimulated both student education and research. The second task has been made possible through the interaction between 'The Sea is Longing for the Forest' social movement and CoHHO studies. A comprehensive five-year research project on the CoHHO was launched where the Connectivity of Hills, Humans and Oceans on the Local Society based on Ecosystem Services in the Fostered Watershed

Environment has been completed in two model fields while studies on the Yura River basin and related sea in Kyoto Prefecture and the Niyodo River basin in Kochi Prefecture were undertaken during the period from 2009 through 2013. Data collected in this project is under detailed analysis.

4. Lessons from the 2011 Earthquake and Tsunami

An earthquake with magnitude 9.0 and intensity 7 unleashed a tsunami that crashed into the northern Pacific coast of Japan in March 2011. People were killed while more than 200,000 people were forced to leave their homes. More than 18,000 are still missing. Since Japan frequently experiences earthquakes, the destruction of houses due to the earthquake was not as severe, but major damage was caused by the tsunami. The earth's crust is still active in the region, with a high probability of more movements within the next 30 years (Oike, 2011). As a result of the 2011 disaster, awareness and the collaboration of 'The Sea is Longing for the Forest' movement and the CoHHO Studies was raised further. The Moune Institute for Forest–Sato–Sea Studies, which is located at the Moune Bay, Kesennuma, Miyagi Prefecture, was established in 2014 through the collaboration with the Kyoto University FSERC, Nippon Foundation, and NPO Mori wa Umi no Koibito. The main aim of the institute is to promote integrated studies— from the headwater areas to the seas and to cover both natural and sociocultural research fields. It is hoped that ASEAN students and researchers will join the young generations of Japanese in advancing the CoHHO idea.

The tremendous power of the earthquake and tsunami demonstrated that Japan's physical structure, which is dependent on highly developed technologies, could be instantaneously destroyed by natural forces. Following this disaster, Hatakeyama declared that the people do not hold any grudges against the sea and expressed his belief that the sea and fisheries can be revived in the foreseeable future. Assessing the impact of the disaster on fisheries resources was difficult because all marine and fisheries research facilities located along the Tohoku Pacific coast had been totally destroyed. A private investigation in Kesennuma and Moune bays was launched as a volunteer research team was assembled in collaboration with the NPO Mori wa Umi no Koibito (Tanaka, 2012). The main purpose of the investigation was to assess the

influences of the earthquake and tsunami on the coastal ecosystem and the recovery process. The first Kesennuma/Moune Bay investigation was initiated on 21 May 2011 and was continued every two months, covering areas from the forest to the sea.

Surveys in the Moune Bay showed a rapid revival of marine organisms. Initially, very few organisms were seen in the water column and the sea bottom that was heavily covered with soft, muddy substances. Seaweed forests along the periphery of Moune Bay were virtually wiped out by a heavy covering of mud. During the summer that followed the disaster, seaweed beds recovered as muddy substrate disappeared; observation revealed consistent increases in fish species and number (Masuda, 2012). Benthic invertebrates, such as sea cucumber, sea squirt, and scallop, which might have escaped from culture cages, were observed at the bottom. The most critical factor for oyster culture is quantity and quality of phytoplankton. During these observations, enough amount of diatom and less of the harmful red tide plankton (dinoflagellates) were noted (Nishitani et al., 2012); these results contributed to the early restart of oyster culture in Moune Bay. At the innermost part of Moune Bay, a wetland/tidal flat area was re-established in an area reclaimed 70 years ago to expand agriculture due to the 70 centimetres (cm) subsidence of the ground. Before the reclamation, this area had been an important source of Manila clams. A study revealed that a huge number of Manila clam juveniles settled in the revived wetland and tidal flat areas, which were dry lands only a year before. The rapid recovery of marine organisms was far beyond the fishermen's prediction and such rapid recovery of organisms encouraged people living in the Moune village. They believed that lessons brought by the earthquake and tsunami should be taken to heart, be looked again at the past, and redraw their future.

In response to the tsunami event, the Japanese government is constructing a gigantic concrete seawall to protect human life and property. A total length of 270 km will be constructed along the Pacific coast of Tohoku. Construction has been done along the sandy beach coast of Sendai Bay and, as of this writing, is being constructed in the Sanriku district with its highly complicated coast. The plan aims to prepare for maximum earthquake magnitude and tsunami size that can be predicted during the next 150 years. The highest seawall planned by the Miyagi Prefecture is 14.7 metres (m), nearly equivalent to the height of a five-storey building, with a base of five to six times its height. The local government explained the seawall plan to the public in mid-July

2012. An association of stakeholders concerned about the plan's impact concluded that (1) the planned height of the seawall could not be changed, (2) no financial support will be provided after the next disaster if the plan is not accepted, (3) other recovery projects would be started after the seawall's construction, (4) this plan is outside of environmental assessment. While many people believe that the seawall plan should be determined or modified based on the future prospects of each community, the reverse process has been ongoing. The inhabitants of Moune village, the birth place of 'The Sea is Longing for the Forest', decided that they wanted to live with a sea rather than behind a seawall. The movement submitted a written request to the government that they wanted to live with the sea by building houses on high ground overlooking the bay. Since the request was submitted before the approval of the seawall construction plan, it was successful and may represent a good example of preventing seawall construction based on local people's request and intervention.

One serious problem in the seawall plan is the lack of an environmental assessment despite its large size and its potential to influence the environment, particularly marine ecosystem. The importance of the connectivity between the forest and sea and water circulation and between land and ocean suggests that the seawall will cause serious problems, hence, the impact of its construction is a theme of CoHHO studies. Experience shows that the construction of such structures can have serious negative impacts. Following an earthquake off southwestern Hokkaido in 1993, a big concrete seawall was constructed to protect the town of Okushiri. Consequently, the most important coastal fisheries significantly decreased and the town's population decreased by almost 70 percent during the last 20 years. In the Ariake Sea in Kyushu, the construction of a seawall caused declines in water quality inside the seven-kilometre embankment, with outbreaks of harmful phytoplankton and accumulation of carcinogenic substance. One of the largest tidal flats in Japan was destroyed by the construction of the large embankment, resulting in the loss of biological function of water purification by benthic animals, like bivalves.

As an alternative to a giant concrete seawall is a forest seawall, which proved effective in Aceh, Indonesia where an earthquake, coupled with tsunami, killed more than 200,000 people. Coastal villages that were protected by dense mangrove forest had significantly less damage than the exposed villages. A similar effect was evident

in the case of the 2011 earthquake in Japan when a seaside forest contributed to reducing tsunami damage on near-shore communities. Dr Akira Miyawaki, an emeritus professor at Yokohama National University, proposed a 'forest seawall', a forest formation on a mound constructed using debris brought by the earthquake, and planting a large variety of tree species. A forest seawall idea has several advantages over a concrete seawall. Aside from being less expensive, a forest seawall would strengthen with time as the trees grow bigger, sending down their roots deep into the soil. In contrast, the concrete seawall will deteriorate with time. This idea has been introduced in Iwanuma city near Sendai, which was heavily devastated in 2011, and where 12 mounds were planted by many tree species along the coast of Sendai Bay. Unfortunately, this forest seawall is inland of the concrete seawall already constructed along the coast of Sendai Bay, so it does not conserve the connectivity of forest and sea.

5. Building the Natural Capital Economy

The giant seawall project was dictated by an analysis of the crisis in traditional economic terms and failed to include what has been defined as natural capital— first defined by Schumacher (1973)—in current economic thought. Natural capital is an extension of the economic notion of capital (resources that enable the production of more resources) to goods and services provided by the natural environment. The Organisation for Economic Co-operation and Development (OECD) defined natural capital as 'natural assets in their role of providing natural resource inputs and environmental services for economic production' and is 'generally considered to comprise three principal categories: natural resources stocks, land, and ecosystems'. The System of Environmental-Economic Accounting (SEEA) contains the internationally agreed standard concepts, definitions, classifications, and accounting rules and tables for producing internationally comparable statistics on the environment and its relationship with the economy. The SEEA is a flexible system in the sense that its implementation can be adapted to countries' specific situations and priorities. Coordination in the implementation of the SEEA and ongoing work on new methodological developments is managed and supervised by the UN Committee of

Experts on Environmental-Economic Accounting (UNCEEA). The final official version of the SEEA Central Framework was published in February 2014 (http://en.wikipedia.org/wiki/Natural_capital).

Since the maintenance of natural capital requires the preservation of cohesive ecosystems, the structure and diversity of the system are important to ensure the long-term sustainability of the resources generated. Plans for the rational utilisation of natural capital for sustainable development have been developed in European nations, but Japan could also produce a unique natural capital economy based on the traditional Japanese idea of co-living with nature. In this context, building the natural capital economy is a goal of 'The Sea is Longing for the Forest' movement and the CoHHO Studies. To illustrate the natural capital idea, it is instructive to look at a recent example of nature's destruction in Japan.

6. Ecological Service of the Tidal Flat

A tidal flat is located just between land and sea and plays an important role in both biological production and diversity. Such ecotones appear to be particularly vulnerable to human impacts and have already been largely destroyed around Japan by filling to create ground for building residences and industrial facilities. Around metropolitan areas like Tokyo and Osaka, most of the tidal flats have disappeared due to reclamation, and the sea is now separated from land by concrete, artificial vertical construction. The destruction of tidal flat around Japan resulted in the remarkable decline in the catches of Manila clam (*asari*) since the 1980s. Total catch of Manila clam in Japan was kept at around 160,000 tonnes in the 1980s but has declined to around 30,000 tonnes in recent years. In the Ariake Sea, the clam catch declined from 90,000 tonnes in the1980s to several thousands in 2000. This trend seems to be similar around Japan's coastal waters, and this kind of Japanese traditional culture of clamming in the seashore is disappearing all over the country. An exception to this trend was noted in Mikawa Bay, Aichi Prefecture, in which 60 percent of total Japanese catch is currently taken. The maintenance of this healthy fishery is due to the comprehensive efforts of maintaining the natural resources—on which Manila clam stocks depend—by the Aichi Prefectural Fisheries Experimental Station (Suzuki, 2010). At present, 80 percent of Japanese total

catch of *asari* come from three neighbouring prefectures including Aichi, Mie, and Shizuoka. An extremely uneven catch was noted in almost all of the Japanese coastal waters, indicating that *asari* has indeed disappeared.

In addition to representing an important traditional food in Japan, the Manila clam plays a very important role in the water purification of coastal marine ecosystem. Aoyama et al. (1996) tried to evaluate the water purification function in terms of economic value of the most important tidal flat for *asari* clam in Mikawa Bay. Issiki has a five-kilometre long and two-kilometre wide tidal flat located in the mouth of Yahagi River. The watershed area has 100,000 people living in it. Daily output of waste from the city is assessed to be nearly one tonne in nitrogen basis. To remove it, it needs a sewage processing infrastructure, maintenance, and personnel costs for a total cost of approximately ¥100 billion for every 50 years. However, the *asari* population could take almost the same role of a ¥100 billion if the *asari* could be conserved in the tidal flat area. Furthermore, *asari* fishing with an annual average of 5,000 tonnes could produce ¥100 billion for 50 years, and still people could enjoy harvesting clams with their families. This is a typical example of an ecosystem service, which has been in the spotlight since the millennium report in 2005.

7. Project for Connecting and Supporting Forest–Sato–River–Sea

Of all the government ministries of Japan, the Ministry of Environment is the most encompassing and overlaps that of other more specialised ministries. It has proposed the creation of a more sustainable society that is characterised by a life civilisation. To realise this, the ministry has initiated the project 'Connecting and Supporting Forest–Sato–River–Sea', which is focused on the integration of the environment, economy, and civilisation. The conceptual basis for the project was provided by the concept and recent advances of 'The Sea is Longing for the Forest' movement and CoHHO Studies. The secretariat of the Ministry of Environment suggested introducing a tax to support the local activities that will connect forest, *sato*, river, and sea on a nationwide scope. This proposal is consistent with the basic concept of CoHHO Studies and with the direction of building the natural economy.

The Japan International Cooperative Association (JICA) has funded a project that could provide a common focus if ASEAN pursues sustainable economic development based on its rich natural resources. JICA has increasingly focused on environmental education and has funded a project in the Philippines that is expected to provide a model that can be applicable to the other ASEAN member countries for teaching the CoHHO concept and practices.

After working in a reforestation activity in the Philippines for five years, a graduate student from the Kyoto University (Kurata, 2013) asked to collaborate and received in 2014 funding for a new JICA project—Environmental Awareness-Raising Project for the Symbiosis between Forest, Human, and the Ocean. The primary objective of the project is to develop the target beneficiaries' role in raising awareness on their environment. The project aims to establish a coordination mechanism amongst local government, local schools, and members of the community that will implement an environmental education programme in their respective communities. Based on the 1.5 years of work, a new programme to promote environmental education for students from elementary to high school under the board of education in Shirai city has been established. This programme will be conducted under the supervision of two universities—La Salle University in the Philippines and the Tokyo Metropolitan University in Japan.

8. Applying the CoHHO Concept and Practices to ASEAN Conservation Efforts

Although megacities are now common in ASEAN member countries, a rural lifestyle based on the primary industries of agriculture, forestry, livestock, and fisheries is critically important. The flow of monsoon rains through ASEAN member countries supports a rich biodiversity and rich forest and fishery resources. Exception for the Lao PDR, ASEAN member countries face the sea. They have a monsoon climate and rich biodiversity under rich precipitation. The world's large rivers, such as the Mekong River and Mae Nam River originating in the Himalayas and the Tibetan Plateau, flow into the South China Sea to bring a large variety of fisheries resources.

An important feature of the ASEAN coasts is mangroves whose ecological importance and contribution to fisheries production cannot be overstated. Mangrove estuarine ecosystems are intimately linked with upstream conditions, which historically consisted of tropical rain forest. This has changed as palm oil production has become so important in many ASEAN member countries. While improving the sustainability of palm oil production has become necessary, reducing its impact on neighbouring ecosystems is also an urgent issue. These mangroves are clearly a tropical example of connectivity between forests and seas. From the CoHHO view, the conservation of mangrove forests to sustain coastal fisheries is a critical issue. A sustainable solution to this issue requires both natural and sociocultural approaches—where the latter must develop people's sense of value for the utilisation and conservation of natural resources. This issue could be addressed as a part of the environmental education programme to enhance the ecological vision of children by their involvement in restoration efforts, such as tree planting in mangrove and tropical rain forest areas.

9. Conclusion

We Japanese people were forced to re-evaluate our lives and the present state of our economy when faced with the disastrous earthquake, tsunami, and the destruction of the Fukushima Nuclear Power Plant. Amongst our key concerns were the condition of our energy supply and the need to establish a more diverse energy supply system that is primarily based on renewable resources. Also we considered to change the energy allocation system—from one that is city-based to a locally diversified system (Ueda, 2014), which could support the local economy while independent of the global economy (Motani, 2014). It was clear to us that placing economic growth before resource conservation was misguided in the long run.

ASEAN member countries could avoid the environmental mistakes of highly industrialised nations caused by ignorance and overwhelming placement of economic growth before environmental conservation. ASEAN could find a more reasonable way to balance the economy and environment for a sustainable future. This requires the development of small-scale economic systems within local communities as

development of local economies appears to be essential in building the natural capital economy (Taniguchi, 2014). As indicated, the most urgent is the creation of a system of locally based environmental education for children so that the following generations could understand their dependence on the natural world and appreciate the critical importance of the ecological connections to the continued supply of goods and services that only nature could provide. While variations in their sociocultural identities make a common ASEAN socio-cultural identity elusive, a common focus on the health of the ecosystem that ASEAN nations share could provide an important binder in building an ASEAN identity. If the ASEAN pursues a path towards sustainable economic development based on its rich natural capital, the basic idea of 'The Sea is Longing for the Forest' and the CoHHO studies may provide a common ground towards establishing an ASEAN identity in the field of environmentalism. The world keeps developing based on highly specialised technologies that have simultaneously created global problems, forcing citizens to realise that a strategic change is needed. The authors of this paper believe that this change must recognise the importance of preserving and rebuilding the connectivity within nature to create a more flexible and sustainable world. We hope that ASEAN member countries will lead in building a sustainable society and share the goals and ideas of 'The Sea is Longing for the Forest' movement and those of the CoHHO studies.

References

Aoyama, H., K. Imao, and T. Suzuki (1996), 'Functions of Tidal Flat in Water Purification in the Case of Issiki Tidal Flat', *Kaiyo Monthly*, 28: 178–88 (in Japanese).

Hatakeyama, S. (2003), *Travelling Brackish Waters around Japan*. Bungei-Syunjyu (in Japanese).

Hatakeyama, S. (2006), *The Sea is Longing for the Forest*. Bunngei-Syunjyu (in Japanese).

Intal, P. Jr., Y. Fukunaga, F. Kimura, P. Han, P. Dee, D. Narjoko, and S. Oum (2014), *ASEAN Rising: ASEAN and AEC Beyond 2015*. Jakarta: Economic Research Institute for ASEAN and East Asia.

Kurata, M. (2013), 'Lessons from the Practical Activities on the Connectivity of Forest–Sato– Sea in Negros Island, Philippines', *ACADEMIA* 140: 47–59.

Kyoto University Field Science Education and Research Center (2011), *Studies on the Connectivity of Forest–Sato–Sea*. Kyoto: Kyoto University Press (in Japanese).

Martin, J.H. and S.E. Fitzwater (1988), 'Iron-Deficiency Limits Phytoplankton Growth in the North-East Pacific Subarctic'. *Nature*, 331: 341–43.

Masuda, R. (2012), 'Underwater Visual Census of Fish Assemblages in Moune Bay, Kesennuma', *Aquabiology* 203: 562–69 (in Japanese with English abstract).

Matsunaga, K. (1993), *The Sea Grows Inanimate when the Forest Disappeared*. Tokyo: Kodansha (in Japanese).

Millennium Ecosystem Assessment (MA) (2005), Ecosystems and Human Well-being: General Synthesis. Washington, DC: Island Press.

Nishitani, G., M. Yamamoto, M. Natsuike, D. Liu, and I. Yoshinaga (2012), 'Dynamics of Phytoplankton in Kesennuma Bay and Moune Bay after the Disaster 3.11', *Aquabiology*, 203: 545–55 (in Japanese with English abstract).

Oike, K. (2011), *Massive Earthquakes in Japanese Archipelago.* Tokyo: Iwanami Science Library 185 (in Japanese).

Schumacher, E.F. (1973), *Small is Beautiful: A Study of Economics as if People Mattered*. London: Blond & Briggs.

Shimizu, N., R. Tateno, A. Kasai, H. Mukai, and Y. Yamashita (eds.) (2014), *Connectivity of Hills, Humans and Oceans—Challenge to the Improvement of Watershed and Coastal Environment*. Kyoto: Kyoto University Press.

Shiraiwa, T. (2011), *The Earth Environmental Studies based on Fish-Bleeding Forest Theory.* Syowado (in Japanese).

Suzuki, D. (2010), *The Legacy: An Elder's Vision for Our Sustainable Future.* Vancouver: David Suzuki Foundation.

Suzuki, T. (2010), 'Water Purification Functions of Tidal Flat and its Restoration', in M. Tanaka, S. Kawai, N. Taniguchi, and T. Sakata (eds.) *Fisheries in the 21st Century—Toward Food Self-Supply from the Sea*. Kyoto: Kyoto University Press (in Japanese).

Tamura, N. (2014), 'Restoring Sea and Forest—Reforesting Activity by Fishermen and Regional Management', in M. Mitsumata (ed.) *Ecology and Commons*. Kyoto: Koyo-Shobo (in Japanese).

Tanaka, M. (2008), *The Way to an Integrated Study on Connectivity of Forest-Sato-Sea.* Junposha (in Japanese).

Tanaka, M. (2011), 'What is the Forest–Sato–Sea Connectivity'? In Kyoto University FSERC *Studies on the Connectivity of Forest-Sato-Sea.* Kyoto: Kyoto University Press (in Japanese).

Tanaka, M. (2012), 'The Aim and Future Perspective of Kesennuma-Moune Investigation on Effects and Recovery from the 3/11 Disaster Conducted in Kesennuma and Moune Bay, Miyagi Prefecture, Japan', *Aquabiology*, 203: 515–23 (in Japanese with English abstract).

Tanaka, M. (2014), 'Will CoHHO Studies Herald a New Age?: Issues and

Expectations', in Shimizu et al. (eds.) *Connectivity of Hills, Humans and Oceans: Challenge to the Improvement of Watershed and Coastal Environments*. Kyoto: Kyoto University Press.

Taniguchi, M. (2014), *Introduction to Building a Natural Capital Economy*. Tokyo: Toyo-Keizai News Paper Press (in Japanese).

Yasuda, Y. (2009), *Civilization of Rice Farming and Fisheries*. Tokyo: Yuzan-Kaku (in Japanese).

ERIA Discussion Paper Series

No.	Author(s)	Title	Year
2016-05	Masaru TANAKA and Shigeatsu HATAKEYAMA	Towards Reframing the Spirit of ASEAN Environmentalism: Insights from Japan's COHHO Experience and Studies	Feb 2015
2016-04	Manaek SM PASARIBU	Challenges of Indonesian Competition Law and Some Suggestions for Improvement	Jan 2015
2016-03	VO Tri Thanh and NGUYEN Anh Duong	Promoting Rural Development, Employment, and Inclusive Growth in ASEAN	Jan 2015
2016-02	Venkatachalam ANBUMOZHI	Convergence of Opportunities: Resilience and the ASEAN Community	Jan 2015
2016-01	Lili Yan ING, Shujiro URATA and Yoshifumi FUKUNAGA	How Do Exports and Imports Affect the Use of Free Trade Agreements? Firm-level Survey Evidence from Southeast Asia	Jan 2015

http://www.eria.org/publications/discussion_papers/FY2015/
http://www.eria.org/publications/discussion_papers/FY2014/
http://www.eria.org/publications/discussion_papers/FY2013/
http://www.eria.org/publications/discussion_papers/FY2012/
http://www.eria.org/publications/discussion_papers/FY2011/
http://www.eria.org/publications/discussion_papers/FY2010/
http://www.eria.org/publications/discussion_papers/FY2009/
http://www.eria.org/publications/discussion_papers/FY2008/