Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HDS07-01 Room:203 Time:May 25 09:00-09:30

Policy developments in Ecosystem- based Disaster Risk Reduction (Eco-DRR) and Climate Change Adaptation

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Since the Indian Ocean Tsunami in 2004, contribution of healthy ecosystems for disaster risk reduction (DRR) started to attract attention globally as many cases were reported that coastal mangrove forests reduced impacts of tsunami. Research and knowledge sharing on this area has also been accelerated since then and a global partnership called PEDRR (Partnership for Environment and Disaster Risk Reduction) to exchange knowledge and experience on this issue was established in 2008 by more than 10 international organizations including IUCN.

Hyogo Framework of Action (HFA), which was adopted as a global framework on disaster risk reduction in 2005 at the 2nd UN World Conference on Disaster Risk Reduction in Kobe, also recognized the importance of ecosystem management under its 4th pillars on addressing underlying risks. This 4th pillar, however, is known as the least implemented elements according to the mid-term review of HFA at the same time. HFA is going to be revised at the 3rd UN World Conference on Disaster Risk Reduction in Sendai, March 2015.

Ecosystems contribute to reducing disaster risk in two important ways. First, healthy ecosystems such as wetlands, forests and coastal systems, can reduce physical exposure to natural hazards by serving as protective barriers or buffers and thus mitigating hazard impacts. Secondly, ecosystems can lessen disaster risk by reducing social-economic vulnerability to hazard impacts. As Ecosystem-based Disaster Risk Reduction (Eco-DRR) can also contribute to the climate change adaption for the longer-term, various examples and knowledge have been collected and practiced on the ground recently.

As a conservation organization, IUCN has been trying to integrate DRR into existing conservation measures such as forest management, ecosystem restoration, integrated water resource management and protected areas management. Particularly, since the Great East Japan Earthquake (GEJE), IUCN has been jointly working with Ministry of the Environment of Japan (MOEJ) to promote the role of protected areas for disaster risk reduction which was inspired by the establishment of Sanriku Reconstruction National Park in the affected area of GEJE.

MOJE and IUCN jointly organized the Asia Parks Congress in 2013 where protected areas and natural disasters were discussed as one of the 6 main topics of the congress. Following this success, MOEJ and IUCN jointly organized some 12 session on protected areas and DRR at the IUCN 6th World Parks Congress in 2014. In addition to that IUCN organized a pre-congress training workshop on PAs and DRR in Sydney. Another global policy development was observed under the Convention of Biological Diversity where a decision titled Biodiversity and Climate Change and Disaster Risk Reduction was adopted at its COP12 in 2014. A similar decision is also prepared under the Ramsar Convection at its COP12 in 205.

This presentation will review recent developments mentioned above on global policy in terms of Eco-DRR.

Keywords: disaster risk reduction, climate change adaptation, ecosystem, biodiversity

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Debate of ecosystem-based disaster risk reduction in Moune District, Kesennuma City after the 2011 Tsunami Disaster

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A magnitude 9.0 earthquake struck the northwestern Pacific Ocean off northeastern Japan on 11 March 2011. The subsequent tsunami wrought destruction on a massive scale. The government's proposed reconstruction plan, released in June 2011 (http://www.cas.go.jp/jp/fukkou/english/pdf/report20110625.pdf), explains that we need to change our attitudes about disaster prevention. For example, although 10-m breakwaters erected in Taro district of Iwate Prefecture worked well against a tsunami caused by the great Chilean earthquake of 1960, they were destroyed by the 2011 tsunami, which killed 200 people and flattened 1,000 houses there. We have to recognize that we cannot completely protect ourselves against natural disasters. Kesennuma City was one of the most heavily damaged regions in Miyagi Prefecture, where more then thousand people were died by the tsunami and fire caused after it, and 230 people are still missing. Kesennuma City is famous for fisheries, especially bonito and pacific saury. However, 2667 people worked primarily at the fishery in Kesennuma City in 2005, only 7.4% of the total employees. Many food processing factories concentrated in the center of Kesennuma were totally destroyed, most of which were located on the reclaimed land. The 77 bank estimated that Kesennuma City lost half of its GRP and one-third of its employment from the earthquake. I analyzed old land uses of the tsunami disaster area in the city center using an old topographical map in 1913, which is the oldest modern one in this area. The result showed that 49%, 17%, 10%, 8% and 7% of affected area was rice paddy, water body, urban area, conifer forest and coast, respectively. Most of water body should be reclaimed from the sea and conifer forest should consist of pine trees along the coast. Miyagi Prefecture has been presented with plans for breakwaters ranging from 5.0 to 11.8 m in height, even though the most recent tsunami topped 12 m. Most breakwaters, totally 25 kilometers, have been already constructed along Sendai Costal Area. A fishing village in Kesennuma, called Moune, has submitted a formal request to the mayor of Kesennuma to withdraw the plan for its 10-m breakwater, because most households will relocate on a new residential area constructed by the government. Moune was the first district to decide the relocation plan to upland and request it to the government.

The district is already famous for its afforestation movement, called Mori wa Umi no Koibito (The Forest is a Lover of the Sea). In 1989, an oyster farmer named Shigeatsu Hatakeyama started planting trees on the hills around the village to preserve the seawater quality for his oysters. His activities have influenced previously-uninterested residents to object to the breakwater plan. Also, Moune has a strong community before the disaster. Four people were killed by the tsunami, but most were survived by helping each other. An association for relocation of residential area has been established since the middle of April 2011, then the general meeting has been held every month. I will discuss ecosystem-based disaster risk reduction of Moune District through the three-years survey.

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HDS07-03 Room:203 Time:May 25 10:00-10:30

Reconstruction of Okushiri Island after the Tsunami Disaster of 1993, from a Disaster Risk Reduction Perspective

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Many reconstruction projects are continuing in the tsunami-hit areas after the Great East Japan Earthquake and Tsunami (GEJET) of 2011. However, some large-scale construction projects have provoked adverse reaction. In Rikuzentakata City, enormous conveyor belts deliver mud for raising the ground level up to an average height of 7.4 meters. However, some researchers have pointed out the negative effects of this action on the ecosystem. There are other instances, such as the controversial construction of massive seawalls along the coast. In the tsunami-hit areas on the eastern coast of Japan, the standard was adopted that the seawalls should withstand a once-in-a-hundred-years tsunami. After the GEJET, gray infrastructure was created in many of the coastal areas. However, some fishermen have complained that the concrete infrastructure obstructed the view of the sea from their houses. Some conservationists have also warned that Japan was depending too heavily on these measures. These topics are under discussion among the national government, local governments, local authorities, the local inhabitants, researchers, and nature conservationists.

Some of the topics include which body decides whether the gray infrastructure should be constructed, and how such a decision was to be made. As regards the tsunami-hit areas of east Japan, a well-argued land-use plan should have been created in an early stage of the post-disaster reconstruction, even though each stakeholder had a different opinion on the subject. To give an example, disaster prevention awareness might be raised while environment awareness might be relatively reduced in the post-disaster areas. Therefore, it is most important that there should be a balanced approach in terms of the land-use plan. If such an approach is followed, the methodology has to be created to combine the land-use plan with the concept of nature conservation. From this point of view, the purpose of this study is 1) to regard the Okushiri Island as a tsunami-disaster-area case study in order to classify the aspects for disaster risk reduction (DRR), and 2) to address the challenges of reaching consensus among the local stakeholders.

With the aim of discerning the future points for discussion, Okushiri Island in Japan was selected as a tsunami-disaster study area in preference to the Sanriku coastal area. In 1993, this island was hit by a tsunami, which led to 172 deaths and 26 missing persons. Some 437 houses were destroyed, while 88 were damaged. The total cost of the damage was approximately 66 billion yen. In the aftermath, based on the evidence of the tsunami, 11-meter-high seawalls were erected on Okushiri Island. However, this reconstruction project has also led to controversy. Literal materials were collected and interviews were conducted in 2014 and 2015 in order to summarize the points at issue. The concerns relating to DRR and the decision-making process were also summarized.

It was found that the local government had placed a priority on the rapid restoration and rebuilding of the infrastructure in the area, including houses, the sewage treatment plant, the town, and the like. Although the ruins of the houses and infrastructures can have warning messages related to a disaster risk, they were not preserved because of this priority. However, the fishermen on the island, anglers, and tourists have complained that the sea was no longer visible from the low land. One of the fishermen expressed the opinion that the poor catch of fish had been caused by ground subsidence, and not by the massive seawall. It was found that there were different approaches to the reconstruction. In respect of Okushiri Island, a top-down approach had been adopted to expedite the reconstruction of the island and to reduce the disaster risks. The results of the study suggest that bridging the gap between the different views on reconstruction and finding common ground for the future is needed.

Keywords: Great East Japan Earthquake and Tsunami, Okushiri Island, Southwest-off Hokkaido Earthquake, disaster risk reduction, decision-making process

HDS07-04 Room:203 Time:May 25 10:30-10:45

Coastal plants restoration project conducted by citizens on sandy coast at the disaster stricken area of East Japan

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Japan is an island country surrounded by the sea. Its inland consists of steep terrain; thus, its population and industry are concentrated in the plains along the coastline. After the World War II, extensive landfills and urban development have been conducted in the coastal areas, including sea wall construction for erosion control, ”black pine forest” plantations as bio-shields, and intensive recreational use, which in turn have resulted in a rapid decrease in its natural resources especially coastal dunes and salt marshes. Coastal dunes and salt marshes are endangered landscapes in Japan so that these landscapes are still remains only extremely low population density area. However such an intensive land use in coastal area has resulted in increasing the risk of disaster like high tides because of the loss of buffer zones between land and sea. As the functions of ecosystem services of beaches and coastal dunes were re-evaluated, gentle slope revetments imitated the ecosystem of coastal dunes came to be built. When people had started to think about coastal environment, the Great East Japan Earthquake struck the Pacific Ocean coast of East Japan on March 11, 2011.

The settlements of coastal areas have been washed away by tsunami that occurred by the earthquake. After the tsunami disaster, but the settlement that created by people disappeared, sand dunes and salt marshes that once were there were revived. The result of interviews with the citizens in disaster stricken areas, it showed that many of the citizens were encouraged to such natural resources that revived. Recently they have started to plant the trees, investigate natural resources, and construct the flower beds by dune plants on the grounds of temporary housing. In addition, experts like ecologists and landscape architects who re-recognized the high beach environment resilience as a buffer zone, were various proposals with a focus on the concept of ”Ecosystem-based Disaster Risk Reduction; Eco-DRR” in reconstruction planning while preserving the diversity of these natural resources as green infrastructure. However, due to rapid disaster recovery projects by construction of larger seawalls and by afforestation of coastal forests by the large-scale embankment, coastal dunes and salt marshes as green infrastructure are beginning to disappear again. Citizen groups that embrace a sense of crisis to the loss of natural resources due to such disaster recovery project, began the efforts to rescue the seeds of coastal dune plants and to restore of these communities on the disaster stricken area.

Kita-no-Satohama Hana-no-Kakehashi Network established in 2014 by Hokkaido citizens have aimed to collect the seeds of coastal dune plants which communities will be lost by disaster recovery project, to cultivate their seedlings in nursery of private company and Ishikari city in Hokkaido prefecture, and to plant these seedlings on disaster stricken area, collaborated with industry, local government, academia and citizen. Last year, a total of 112 people, include volunteer group, junior high students and faculties, conducted sowing in May, and a total of 55 people planted on the beach in front of new seawall and the slope of embankment for new coastal forest. After the seedlings transplant, they have continued to monitoring the survival status of seedlings and considering the plan for next season.

Still many issues are there in this project. First is to ensure the funds for project. Last year, they raised funds through crowdfunding, materials were provided from private companies. In order to sustained projects, it is necessary to ensure a stable source of revenue. Second is a disease and genetic disturbance caused by transport of seeds. Because there is also negative opinion to their project, establishment of a more secure method is required. Third is the lack of counterpart. In order to sustained projects, it is desirable to provide a multi-layer exchanges opportunities with various ages.

Keywords: the Great East Japan Earthquake, coastal dune plants, ecotone, resilience, green infrastructure, seeds

HDS07-05 Room:203 Time:May 25 11:00-11:15

The difference of vegetation formation and radioactivity accumulation due to different estuary forms

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1. Introduction

A large amount of radioactive nuclides (^{131}I, ^{134}Cs, ^{137}Cs, etc.) were released into the environment by the accident which occurred at the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Company on March 11, 2011. Particularly in estuaries, the accumulation of sediment by the catchment from the entire basin and the accumulation of radioactivity substances easily occur; we considered this to be affected due to the differences in the estuary's form (obstructed and open type estuary). However, there are not yet any study examples to be examined in detail about these contents.

In this research, we aim to be clear about the effect of the radioactive pollution on the plants by investigating the local environment (community component species, soil, spatial dose rate) and the ^{137}Cs absorption property of plant communities that are distributed near the different forms of estuaries.

2. Study site and methods

The study sites were the Niida River and Mano River, second-class rivers, located in the Minamisoma City, Fukushima Prefecture. As for estuary form of these rivers, the Niida River is an estuary obstruction type and the Mano River is an estuary opening type. The investigation was conducted on June late in 2013. The range of study sites were the main plant communities (*Phragmites australis*, *Typha domingensis*, *Miscanthus sacchariflorus*) that were distributed along the estuary, midstream and upstream of both rivers.

In methods, we conducted GPS survey marking 5 quadrats to each plant community, and then measured the spatial dose-rate in each quadrat. We also collected sediment cores from about 30cm deep from the surface layer using a PVC pipe. The cores were removed and sealed, maintaining the layer state, and we measured the PH and salinity of the pore water of the core hole via electric conductivity (we measured the electric conductivity as an indicator of the salts). The measurement of biomass in each quadrat was repeated for the above-ground part of the plant (0.5m $*$0.5m), and weighed.

3. Results and Discussion

The biomass of the main plant communities(*Phragmites australis*, *Typha domingensis*, *Miscanthus sacchariflorus*)were higher in Niida river. Concerning the spatial-dose rate of each plant community of both rivers, the *Phragmites australis* community was higher in Niida River, the *Typha domingensis* communities showed no significant difference, and the *Miscanthus sacchariflorus* community was higher overall in the Niida River. We considered that Niida River become a freshwater tidal area due to the suppression of sea water going upstream by estuary obstruction. Moreover, with the progress of the sediment accumulation from upstream, nutrient concentrations in the soil which accumulated in the estuary and part of the vegetation locations were higher, therefore, the biomass and density of *Phragmites australis* and *Miscanthus sacchariflorus* were higher. At the same time, because the sediment containing radioactive material that was carried from upstream is likely to be accumulated in the estuary, the spatial dose rate in plant communities became higher. On the other hand, the Mano River has no estuary obstruction, and the sediment is likely to overflow during floods. We considered the because salt water is going upstream during high tide, the density of *Phragmites australis* community was low due to salt stress, the sediment deposition is small and spatial dose-rate was low compared with that of the Niida River. We considered that community density of the *Typha domingensis* community was low compared with that of *Phragmites australis*, sedimentation is small without a decrease in river flow velocity, and the accumulated volume of the spatial dose-rate in the community was low when compared with the *Phragmites australis* and *Miscanthus sacchariflorus* communities.

Keywords: Radioactive Nuclides, Estuary form, Space Dose Rate, Plant Communities, Biomass, Salinity