Keio University
RCCCA

ASIA PACIFIC ADAPTATION NETWORK

PROCEEDINGS REPORT:
EDUCATIONAL PROGRAMME ON A SEMI-ARID ENVIRONMENT SUSCEPTIBLE TO CLIMATE CHANGE IN NORTHEAST ASIA
25 AUGUST - 3 SEPTEMBER 2012, HORQIN SANDY LAND, INNER MONGOLIA, CHINA

Keio University's Research Centre for Climate Change Adaptation (RCCCA)
under Asia Pacific Adaptation Network (APAN)

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INTRODUCTION

Climate change is unambiguous in the northeast Asian nations of Mongolia, China, Korea and Japan. However, geography, economics, and cultural issues create significant differences when it comes to the ultimate effects of climate change in each country, and similarly constrain the resources available to tackle the problem. In many cases the effects are local and can be responded to at the level of a community or local government. At the same time there are many instances where the effects of climate change are regional and cross national borders, meaning that cooperation between countries is necessary.

Climate change is expected to cause various new problems, such as sea level rise and species extinction, but is equally likely to exacerbate existing problems. One such example is desertification, which is already one of the severest environmental problems in the world including northeast Asia. The definition of desertification by the Convention to Combat Desertification is "land degradation in arid, semi-arid, and dry subhumid areas resulting from various factors, including climatic variations and human activities." IPCC (2007a, b) showed that those dry areas are susceptible to climate change, and Xu et al. (2011) said that climate change is a major driving force in desertification, just as influential as human activities. In northeast Asia, China has most suffered from desertification for a long time, but other northeast Asian countries have also been affected in the form of dust storms from China. In this way desertification has had both local and cross-border influences, and now each country pays much attention to it.

Japan has previously cooperated with China in combatting desertification at the government, academic, and grass-root levels. Unfortunately, some of the Japanese projects were not effective because they were often narrow-minded and one sided, aimed exclusively at the photogenic task of planting trees without duly considering local socio-ecological conditions. In recent years, however, Japanese researchers, NPOs, and NGOs have worked together with local people such as local governments, researchers, and residents in order to develop a better outcome. In this context a central challenge is the integration of the many individual approaches, each separately made by the different levels or stakeholders. The first step to achieve some kind of integration is to understand each approach and gain a holistic point of view.

The RCCCA was founded in part to address adaptation issues, primarily through training and network building at the scale of communities and through academic connections. In this sense, we organized an educational programme for students to study desertification, and adaptation to it, in cooperation with different local stakeholders. This programme was carried out in the Horqin Sandy Land from 25 August to 3 September 2012 and consisted of fieldwork and a workshop. The Horqin Sandy Land is one of the most desertified regions in the world and as a result many researchers, practitioners, and local governments work on desertification in the area. Those stakeholders supported the programme.

PROGRAMME OVERVIEW

The programme was supported by Japanese NPO "Green Network" and Naiman Desertification Research Station (NDRS) of Chinese Academy of Sciences (CAS), and local government. Green Network was established in 2000 with the goal of restoring the Horqin Sandy Land. They work together with local people so that their activity becomes community-based and self-sustaining in the future. NDRS was founded in 1985 as a field research station of CAS. They work on various research on desertification in cooperation with domestic and overseas institutes, such as the University of Tokyo and National Institute for Agro-Environmental Sciences.

In the first half of the programme, students from the Japanese universities (Keio University and the University of Tokyo) joined environmental restoration activities performed by the NPO. They studied not only individual restoration techniques but also a community-based restoration approach that was a kind of adaptation in the local society. Next, they visited NDRS to attend the workshop consisting of the following four parts: (1) lectures on the activities of NDRS (by Professor Xueyong Zhao, director of NDRS), RCCCA (by Professor Wanglin Yan, director of RCCCA), and the local government (Mr. Chunming Zhang, former director of the forestry bureau of the local government); (2) round table discussion with students at CAS about research and practice on desertification in this area; (3) training on vegetation and soil surveys and laboratory analysis; and (4) an excursion to a large sand-dune area.

Site description

The programme was carried out in two areas located close to each other in the southern part of the Horqin Sandy Land: Horqing Left Back Banner and Naiman Banner, Inner Mongolia of China (Fig. 1).

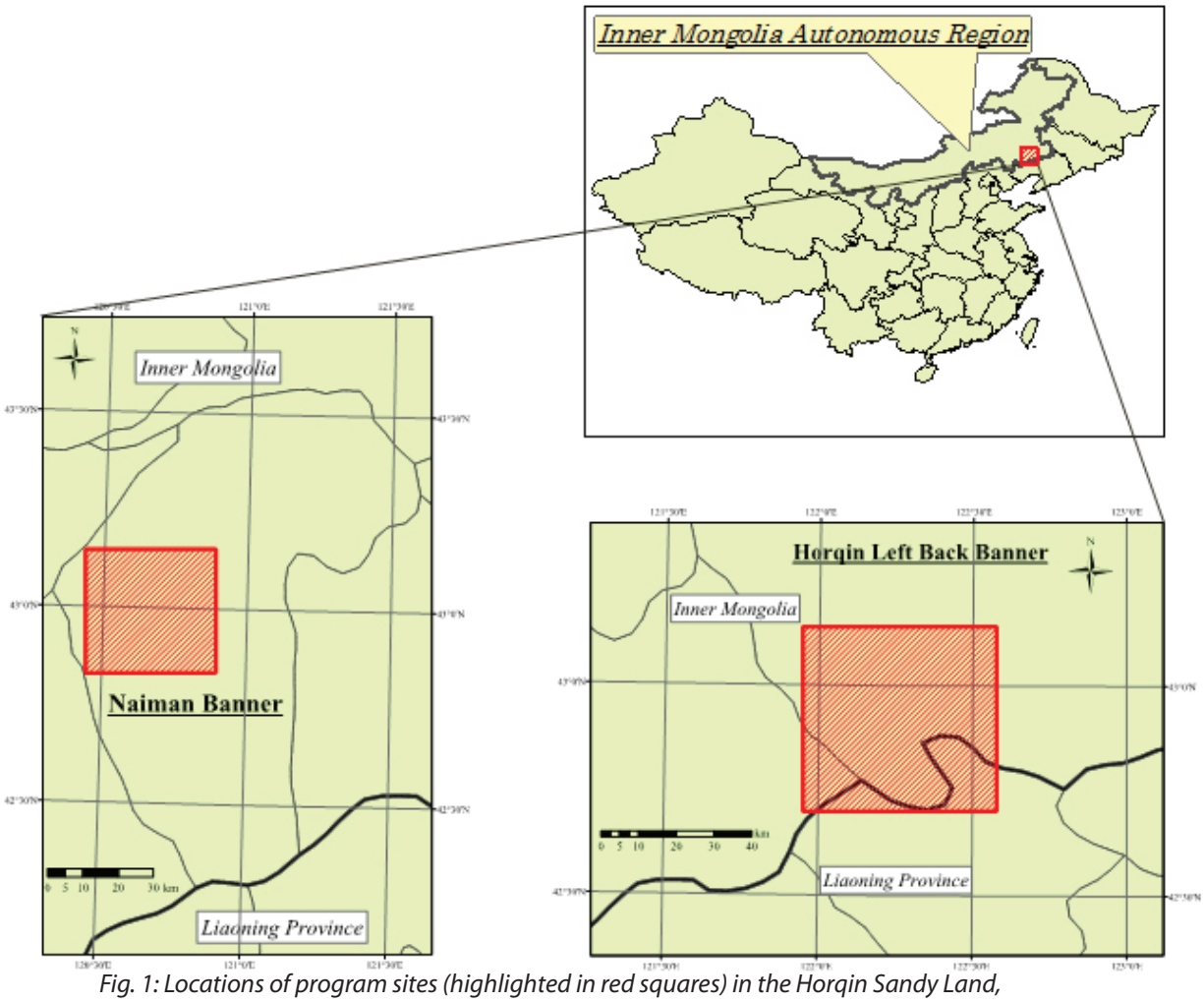

Fig. 1: Locations of program sites (highlighted in red squares) in the Horqin Sandy Land, northeastern China.

The Horqin Sandy Land is in a temperate zone with a continental semi-arid monsoon climate; this means spring is dry and windy, and more rainfall is received in the summer months than during other times of the year. According to the statistics of the Naiman Weather Station (1961–2000), the mean annual precipitation is about 366 mm, and much of the precipitation falls between June and August. The mean annual temperature is about 6.8 °C, and the coldest and warmest monthly mean air temperatures are –13.1 °C in January and 23.7 °C in July, respectively. The Aeolian sand on which soils have formed is thought to have originated from alluvial and lacustrine deposits formed in the Late Pleistocene period, and fixed sand dunes formed in association with soil development during the Holocene Optimum (Yang et al., 2010). The threshold wind velocity for sand movement (about 4 m s−1 at 2 m height; Hu, 1991) is exceeded on more than 200 days each year (Li et al., 2002) and resulting wind erosion is a very serious problem during the period from the thawing of the frozen surface soil in mid-March to the sowing of crops at the end of April (Li et al., 2004).

The agricultural system can be classified into semifarming and semipastoral. Maize monoculture dominates the cultivated land while livestock consist mainly of sheep, goats, and cattle. Horses are kept mainly for riding and as draught animals.

Schedule

Aug. 26	8:00 a.m. to4:00 p.m.	Restoration activity (planting pines)
	4:00 p.m.to5:00 p.m.	Discussion with local people
Aug. 27	8:00a.m. to 12:00 p.m.	Restoration activity (straw checkerboard)
	1:00.m. to 5:00 p.m.	Restoration activity (pruning)
Aug. 28	8:00 a.m. to 12:00 p.m.	Restoration activity (weeding)
Aug. 29		Move from Horqin Left Back Banner to Naiman Banner Brief meeting at NDRS
Aug. 30	7:30 a.m. to 11:30 a.m.	Training on vegetation and soil surveys
	2:00 p.m. to 6:00 p.m.	NDRS tour
Aug. 31	7:30 a.m. to 11:30 a.m.	Workshop (lectures and discussion)
	2:00 p.m. to 6:00 p.m.	Training on vegetation and soil surveys
Sep. 1	7:30 a.m. to 11:30 a.m.	Training on vegetation and soil surveys
	2:00 p.m. to 6:00 p.m.	Training on laboratory analysis
Sep. 2	7:30 a.m. to 11:30 a.m.	Excursion

RESTORATION ACTIVITIES

The participating students worked not only with the NPO but also with a Japanese company, named JBCC Holdings Inc., which supports the restoration activity of the NPO as part of their CSR (corporate social responsibility) program. Local residents, who usually work with the NPO, also joined the project. This was particularly fruitful for while we scheduled a specific discussion time with locals regarding desertification in this area and how to adapt to the problem, the students talked with them spontaneously while they worked together. Under the supervision of the NPO and the local people, the students conducted the following restoration activities:

Planting pines

Pines have a relatively long life span and do not need much water to survive, so they do not put heavy pressure on land. Planting pines, however, should be carried out in the rainy season (July to August) because pine saplings need a certain amount of water. The students dug holes 30 cm deep with about 4 m space in between and planted a pine sapling (coated by plastic to protect from drying) into each hole (Fig. 2). The saplings were watered by the bucket brigade method (Fig. 3) because the number of wells was limited.

Straw checkerboard

The students established straw checkerboard barriers on a sand dune. These fix shifting sand dunes and are widely used in China to ease wind erosion and to facilitate plant establishment. Straw from wheat, rice, maize, or other materials is placed in the shape of a checkerboard (Fig. 4). Half is buried in the sand and the other half is exposed. After establishment, the straw gradually rots to become organic matter (soil).

Fig. 2 A pine sapling and a dug hole.

Fig. 3 Bucket brigade (or human chain) for watering.

Fig. 4 Establishment of straw checkerboard barriers.

Pruning and weeding

The students pruned branches of pines that planted a few years earlier (Fig. 5). Such pruning stimulates the vertical growth of the trees and increases the nurse effect as shelterbelts. Students also weeded around the planted pines (Fig. 6). Since weeds compete against planted trees, weeding is necessary for some period after planting.

Fig. 5 Pruning Fig.

Fig. 6 Weeding

TOUR OF NAIMAN DESERTIFICATION RESEARCH STATION

The students from Japan were shown around the research station by the station staff. Professors, researchers, and graduate students at Cold and Arid Regions Environmental and Engineering Research Institute of CAS reside in the station from April to September to conduct various research in the field. The station was mainly composed of six buildings and experimental fields. The six buildings include an office building with guest rooms, a dining hall, two student dormitories, an auditorium including a meeting room and an exhibition room, and a laboratory building. The laboratory building is itself divided into five sections: agricultural, plant physiology, soil, grassland, and micrometeorology. About 200 pieces of equipment are found in the laboratory, including a plant photosynthetic analyzer, atomic absorption spectrometer, nitrometer, micro-lysimeter, spectrophotometer, flame photometer, and CO2 analyzer. The experimental fields were set up for a grazing experiment, vegetation restoration on shifting sand dunes, nutrient cycle and water balance observations, micrometeorological measurements and so on. Figure 7 shows some pictures taken during the tour.

Fig. 7 Facilities of Naiman Desertification Research Station

TRAINING ON VEGETATION AND SOIL SURVEYS AND LABORATORY ANALYSIS

We offered the students from Japan hands-on training in order to experience how to estimate land conditions in a quantitative way, with the help of the students at CAS.

The landscape of the Horqin Sandy Land is characterized by sand dunes alternating with interdune lowlands. Since sand-dune ecosystems are generally dynamic environments determined by wind erosion, sand accumulation, and dune encroachment, the distribution of plants and soil conditions are strongly affected by the topographic positions of the sand dunes.

The students established a line along a topographic gradient of a sand dune and three quadrats (1 x 1 m) at each of three topographic positions along the line: lower part, middle part, and upper part of the sand dune. They recorded the percentage cover of all plant species and collected soil samples from 0 to 5 cm depth in each quadrat. Water content of soil from 0-6, 10, 20, 30, 40, 50, and 60-66 cm depths was also measured with a soil moisture sensor. Figure 8 shows some training scenes.

Although statistical data analysis using vegetation data obtained was omitted because the number of samples was insufficient, two soil analyses were conducted in the laboratory of NDRS: hydraulic conductivity of soil (falling head permeability test, Fig. 9) and soil organic matter content (ignition loss method, Fig. 9).
Workshop

Fig. 8 Training on vegetation and soil surveys.

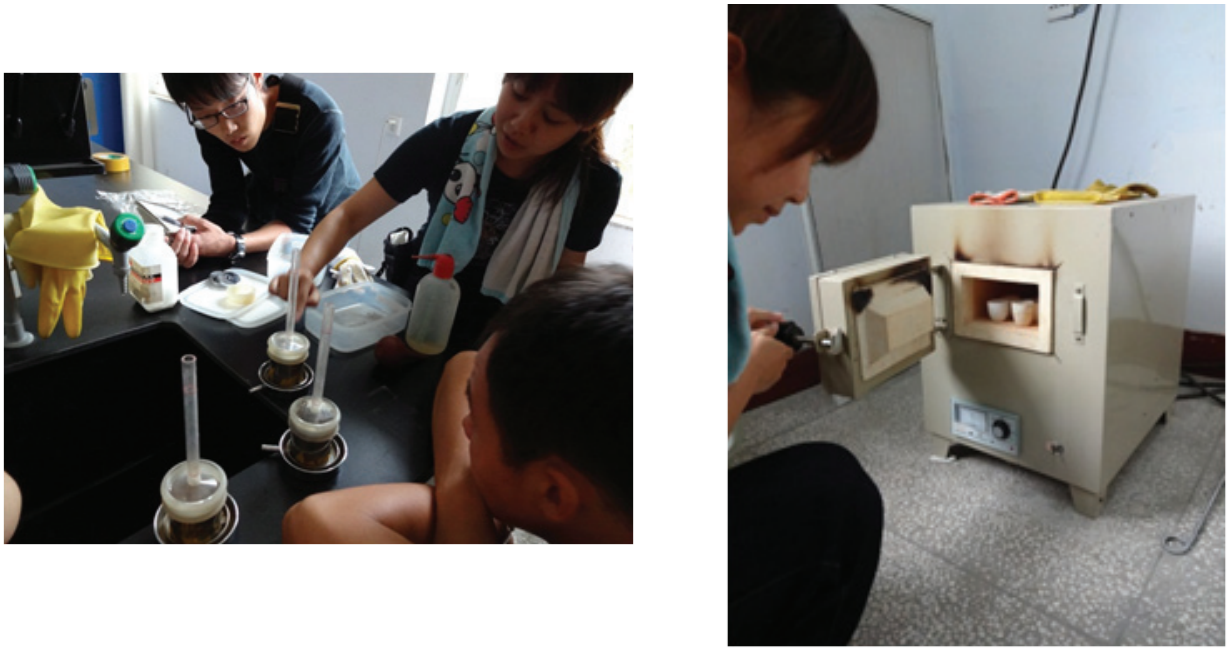

Fig. 9 Training on soil analyses: left, falling head permeability test; right, ignition loss method.

WORKSHOP

In the workshop (lecture and discussion parts, Fig. 10), Professor Zhao, director of NDRS, gave a talk on NDRS and its research activities; Professor Yan, director of RCCCA, talked on RCCCA and its educational activities; and Mr. Zhang spoke on the local government's activities and perspectives on desertification.

Mr. Zhang's talk is summarized as follows:
When desertification in this area was most severe, we were not able to open the door of our houses in the morning because of the moving sand. More than 20 villages were forced to move in order to escape from the sand. Maize-sowing, which was supposed to be undertaken in April, had to be postponed until May because of dust storms in spring. As a result, the growth period was not long enough to harvest as large a yield as before. Additionally, pasture productivity was generally low, so a lot of the livestock suffered from malnutrition and were not able to survive the winter. The local government realized the seriousness of desertification in the 1980s and started to plant trees and grass and to ban livestock grazing. The effects of those measures were limited in the 1990s because of a lack of funding and the difficulty of banning grazing, which local people needed to earn a living. In the 2000s, however, sedentary livestock production technology was introduced, and some country-level subsidy policies, such as Sloping Land Conversion Programme, was launched, and the ecological conditions gradually improved.

Ecological restoration leads to improvement in the economy. Now we consider groundwater resources and do not blindly plant trees. Although poplars, which need a large amount of water to grow, used to be the chief planted tree type, other species, such as pines and indigenous shrubs, are now being selected in many cases. We have realized that we need to live in harmony with nature.

In the round table discussion, unfortunately Professor Zhao was not able to attend, but students at the Japanese universities and CAS discussed with Professor Yan and Mr. Zhang about various topics, e.g. future strategies on planting, usage and management of already planted trees, responses to a future funding issue (the current country-level subsidy policies cannot be continued forever), research subjects needed in the future, international cooperation on technology and education, and student exchange between Keio university and NDRS. Although conclusions were not clearly made for most of the topics, students from both sides said that they had never had this kind of discussion, and it broadened their horizons.

EXCURSION

Interestingly, some large sand dune areas are purposefully left in Naiman Banner and are used as tourism resources (Fig. 11).

Fig. 11 Excursion in a large sand dune area used as a tourist spot in Naiman Banner.

CONCLUSION

Students from the Japanese universities learned about desertification by engaging with grass-root activities, scientific research, and a governmental perspective based in the field as viewed through the educational programme. Although the students at CAS had intensively worked on desertification already, they mainly focused on basic research and did not have a holistic point of view. Therefore the programme became a good chance for them to broaden their horizons. In addition, a relationship between RCCCA and NDRS was established, and future cooperation including a student exchange programme and an international symposium was discussed.

Since the programme was completed on such a positive note it is set to be repeated. However, the students at CAS attended only the second half of the programme and was more like a host this time. Next time, they should be invited to activities outside the research station, such as the restoration activity with the NPO. Furthermore, political perspectives were not sufficiently included, so that we plan to visit different departments that are relevant to desertification, e.g. forestry, agricultural, and agricultural and animal husbandry bureaus, and interview with officials. This would be a stimulus for students not only from Japan but also at CAS. It offers the opportunity to take their thinking about desertification deeper and in a different direction.

ANNEX

List of Participants

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