

Joint Research on Dust and Sand Storms (DSS) among China, Korea and Japan



1. Brief introduction of tripartite joint research on DSS
2. Results of field survey in 2014
3. Future plan conducting intensive field survey

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Under the framework of TEMM

- Recognizing the seriousness of the desertification and its DSS effects, the Tripartite Environment Ministers Meeting (TEMM) among China, Korea and Japan initiated a joint research on Dust and Sand storms (DSS) in 2008 with two working groups (WGI and WDII).
- **WGI**: to develop DSS forecasting models, conduct joint research to improve their accuracy, and establish effective monitoring and early warning system.
- **WGII**: to promote joint research analyzing success factors for ecosystem restoration and developing new countermeasures for prevention and control of DSS



Research Plan (2008-2010)

- On the 1st Tripartite WGII meeting in 2008, research plan 2008-2010 agreed following objectives to develop **new ways to evaluate restoration practices** and to suggest an advanced model to combating desertification
- - To analyze biological and physio-chemical aspects of ecosystem restoration projects
- - To analyze socio-economic impacts of ecosystem restoration projects and survey public opinions
- - To develop an advanced model of ecosystem restoration project, based on the determinants of project success

Mid-term joint research strategy (2011-2015)

- Mid-term joint research strategy (2011-2015) was proposed on the 4th Tripartite WGII meeting in 2011
- - to analyze the causes of land degradation and desertification in **Hulunbeier desertified area**, and selected two sites, Ganzhuer and Wangong as intensive survey sites.



フルンボイル周辺の緑化
サイトで、緑化の成果につ
いての調査をした。

New joint research action plan (2015-2019)

- New joint research action plan (2015-2019) discussed at WGII meetings in 2014 aims to promote **environmental rehabilitation** towards sustainable land use in DSS source and desertified area by integrating knowledge of the reactive and proactive approaches to combating desertification.

Approaches to combating desertification

- Desertification process
 - carrying capacity, threshold...
- Monitoring and assessment
 - hotspot, effectiveness of remedies...
- Countermeasures
 - prevention, restoration...
- Sustainable land use system
 - cropping system, grazing control...

Diagnosis



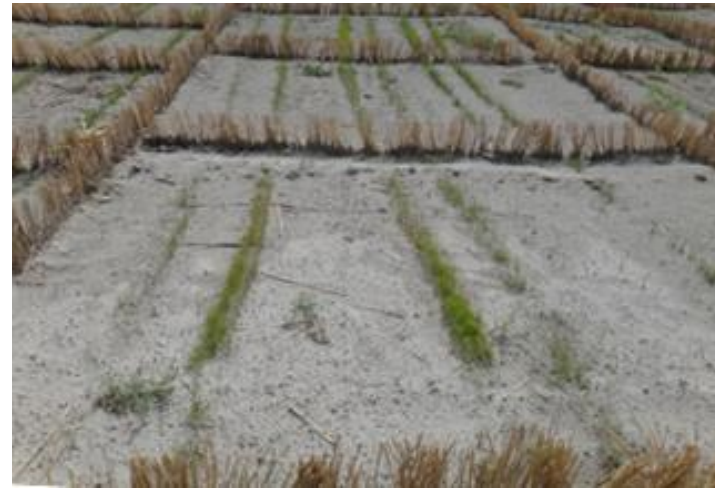
*Treatment
(reactive)*



*Prevention
(proactive)*

Results of Field Survey in Hulunbeier in 2014

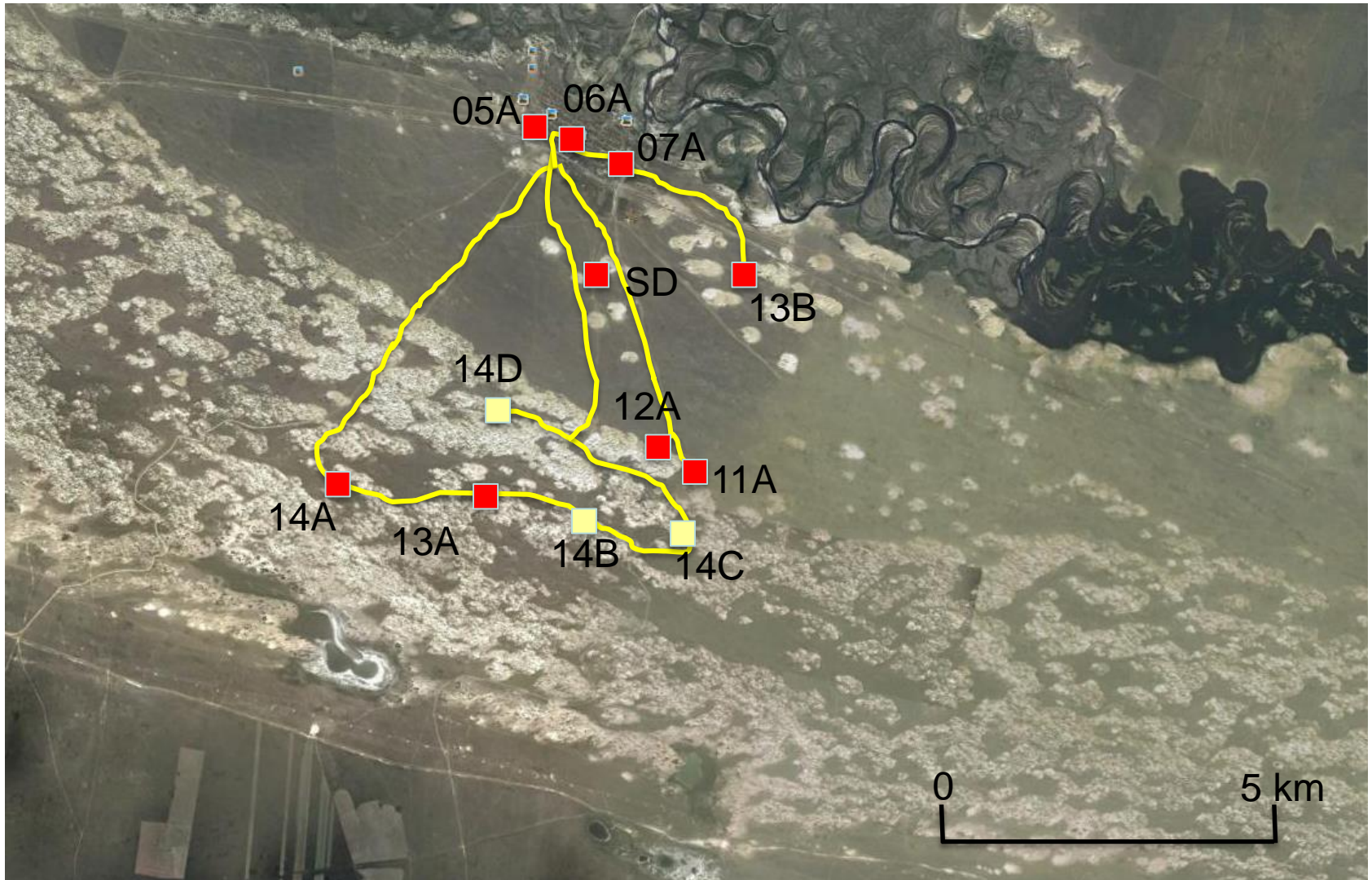
- At the field survey in 2013, we were very much interested in the field trials for sand fixation and vegetation restoration using **native plants**, and we decided to focus on the topic of development and assessment of new measures to restore degraded land in Wangong and surrounding area.



Purpose of the field survey

- The specific purposes of our field survey are:
 1. to confirm the exact conditions of treatments (restoration measures), replications etc., in the sand fixation project sites and decide the sites for the field investigation,
 2. to conduct preliminary field measurement to describe patterns of land and vegetation restoration,
 3. to discuss the possibility of cooperative field investigations starting from 2015 and other items.

Location of 12 candidate sites in Wangong



List of the candidate sites

Name	Year	Seeding treatment	Checkerboard size/materials	Fence	Initial land condition
14A	2014	Elymus+Caragana	1x1m with hay	OK	Shifting dune
14B-D	2014	Elymus+Caragana (sown since last week)	1x1m with hay	OK	Shifting dune
13A	2013	Elymus+Caragana	1x1m with hay	OK	Shifting dune
13B	2013	Elymus+Caragana+ Agropyron	1x1m with hay	OK	Shifting dune
12A 11A	2012 2011	Elymus+Caragana	1x1m with hay	broken	Shifting dune
07A 06A	2007 2006	No/Agropyron	No?	OK	Shifting dune nearby railway
05A	2005	Agropyron	No?	OK	Shifting dune nearby railway
SD	2014	No	No	OK	Shifting dune

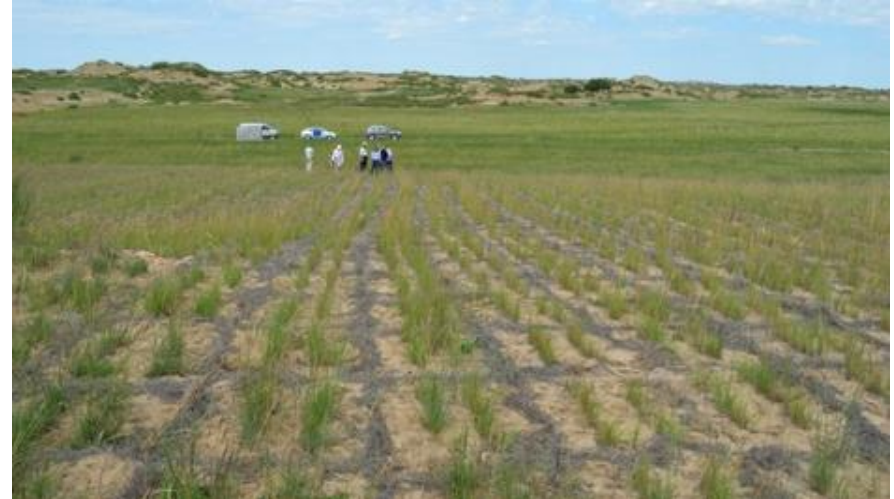
Check list for site selection

1. *Year* (Period of treatment): Is the year of the implementation of the countermeasure correctly confirmed?
2. *Treatment* (e.g. seeding/checkerboard materials): Is the detailed content of the treatment (species, amount of seeds, materials for checkerboard...) confirmed?
3. *Fence*: Has the site been well-managed/maintained? (strictly protected from grazing or any other disturbances?)
4. *Initial land condition*: Is the initial land condition same among the survey sites (e.g. vegetation cover, species composition, topography, dune shape/size)?

Selected sites



14A:Elymus+Caragana in 2014



13A:Elymus+Caragana in 2013



13B:Elymus+Caragana+Agropyron in 2013



14D: No seeding/no checkerboard in 2014

Field investigation

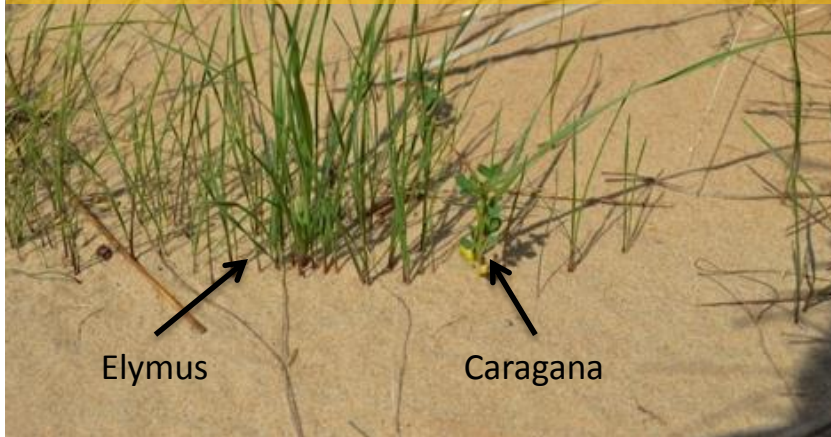


Topography --- micro landform, slope angle from the top to the bottom of dunes



Erosion pin

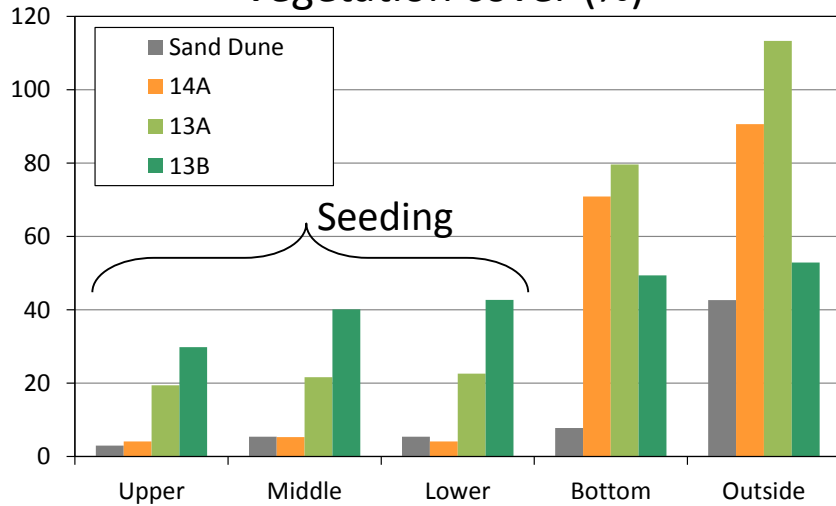
Vegetation --- species composition, cover, height, frequency, survival rate, etc.



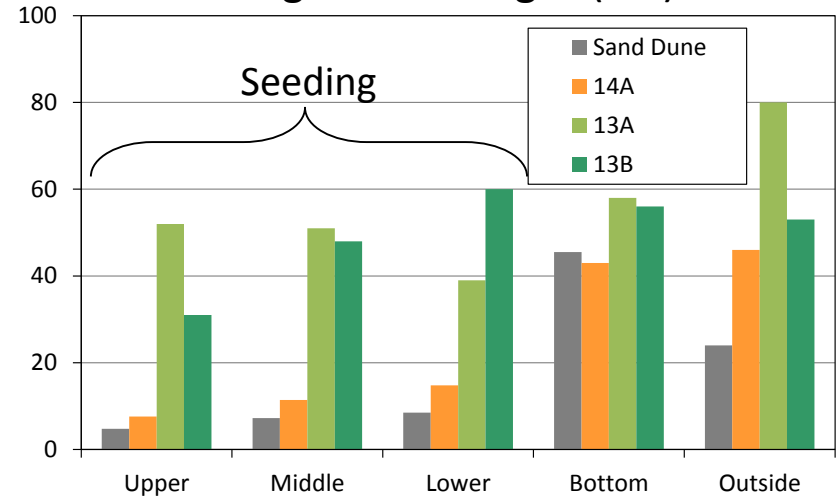
Sand movement/fixation --- burying erosion pins

Comparison among different treatments and topographic locations

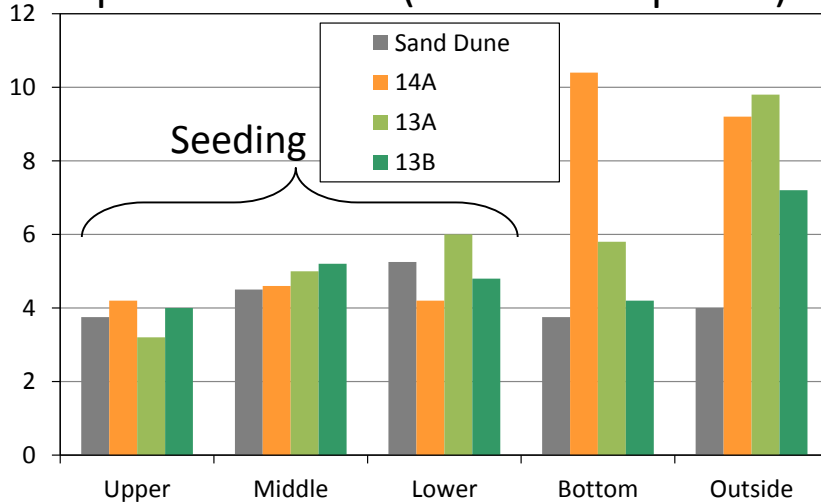
Vegetation cover (%)



Vegetation height (cm)



Species richness (number of species)



Fenced in 2014

Sand Dune: No seeding

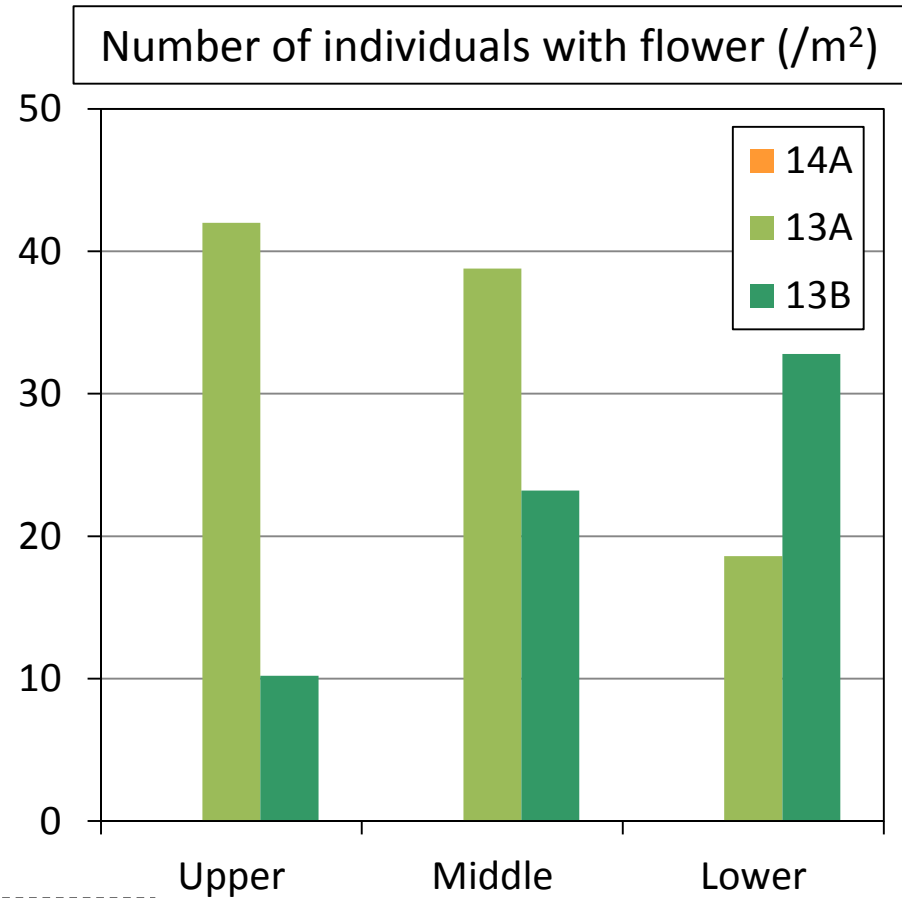
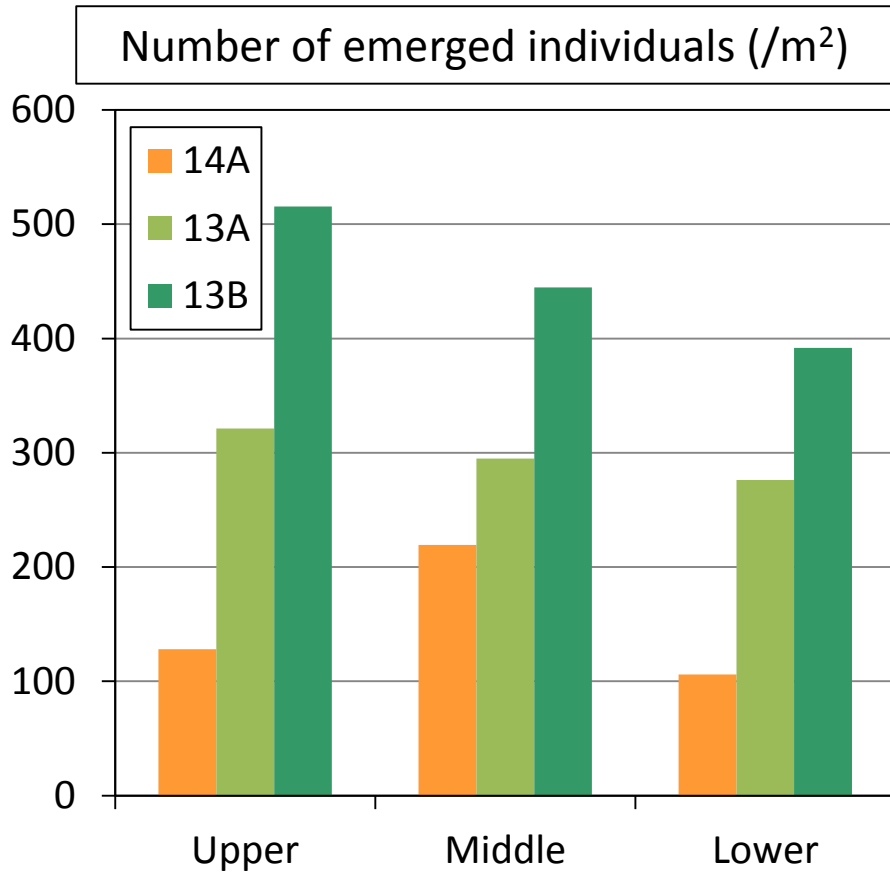
14A: Elymus+Caragana

Fenced in 2013

13A: Elymus+Caragana

13B: Elymus+Caragana+Agropyron

Comparison of abundance of **sown species** among different treatments and topographic locations



14A: Elymus+Caragana, fenced in 2014

13A: Elymus+Caragana, fenced in 2013

13B: Elymus+Caragana+Agropyron, fenced in 2013

Future Plan

1. Conducting intensive field survey at the sites which we selected in 2014.
2. Measuring the following items in addition to 2014's measurement;
 - Wind Erosion by measuring sand erosion/sedimentation around erosion pins.
 - Soil property: particle size, pH, EC, C, N, Ca, Mg, K₂O, P₂O₅ etc.)
 - Forage quality: Plant crude protein (CP), total fat, crude fiber (CF) and the mineral content (Ca, Mg, K, Na)
3. Conduct germination test and growth experiments for typical plants (*Elymus*, *Avena*, *Agropyron*, *Caragana*)
4. Installing equipment for the measurement of weather and sand movement.


General Research-grade Weather Station and Sand collector

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

SYSTEMS

GRWS100
General Research-Grade Weather Station

Reliable Weather Monitoring
General-Purpose Weather Station



Measurements

- Wind speed
- Wind direction
- Air temperature
- Relative humidity
- Barometric pressure
- Precipitation
- Solar radiation—sun plus sky radiation

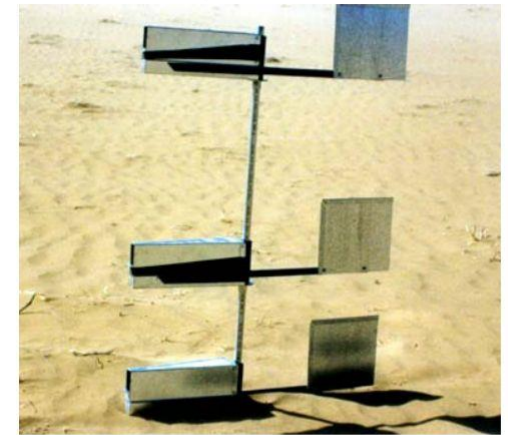


Figure 1a - USDA (BSNE) Sand Catcher

List of the equipment for the measurement of weather and sand movement

Equipment	Note
Pyranometer	Measuring total sun and sky solar radiation
4-component net radiometer	Measuring balance between incoming short-wave and long-wave infrared radiation versus surface-reflected short-wave and outgoing long-wave infrared radiation
Wind monitor	Measuring wind speed and direction
3-D sonic anemometer	Measuring three orthogonal wind components and the speed of sound.
Temperature and relative humidity probe	Measuring temperature and humidity
Rain gage	Measuring rainfall
Soil temperature probe	Measuring the average temperature of the top 6 to 8 cm of soil for energy-balance in flux systems
Soil water content reflectometer	Monitoring soil volumetric-water content, bulk electrical conductivity, and temperature
Horizontal mass flux remote site field sensor	Measuring mass of saltated sand particles
Sand collector	Measuring mass of saltated sand particles.

Potential supplier:

Campbell General Research Grade Weather Station GRWS100

Other recommended supplier from CRAES and MEP

Potential budget:

1,000,000 – 4,000,000 Japanese Yen (JPY) from Japan

Mid-term time table for the joint research

		2015	2016	2017	2018	2019
(1) Monitoring and Assessment	(1) Basic observation	Installation and validation of monitoring equipment	← Monitoring survey of vegetation, soil, topography and meteorology →			
		Setting up study and preliminary survey	← Investigation of benchmark and indicator for assessment →		← Assessment of the effect of countermeasures by applying selected B&I →	
	(2) Sand emission observation	Installation and validation of monitoring equipment	← Monitoring survey of dust and sand emission →			
		Setting up study and preliminary survey	← Investigation of methodology to combine observation data with sand emission model in WG1 →		← Investigation of methodology to combine observation data with regional monitoring in WG1 →	
(2) Development of new measures	Preliminary survey on planting/seeding methodology	← Implementation of restoration experiment and monitoring survey of vegetation, soil, topography and meteorology →				
	Selection of target species and collection of seeds for experiments	← Trade-off analysis of ecosystem services →		← Assessment of the effectiveness and investigation of the method of disseminating new measures →		

Thank you



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