

15 November 2013, Sendai International Center, Sendai, Japan

The First Asia Parks Congress

WG1: Natural disaster and protected areas

Huge earthquake/tsunami disturbance, autonomous
ecosystem recovery and the human impact of reconstruction
in the Sendai Bay sand-dune coastal ecotone

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On 11 March 2011, huge tsunamis
afflicted the Sendai Bay fringe

*Crustal disturbances caused by the earthquake
registering a Mw 9.0*



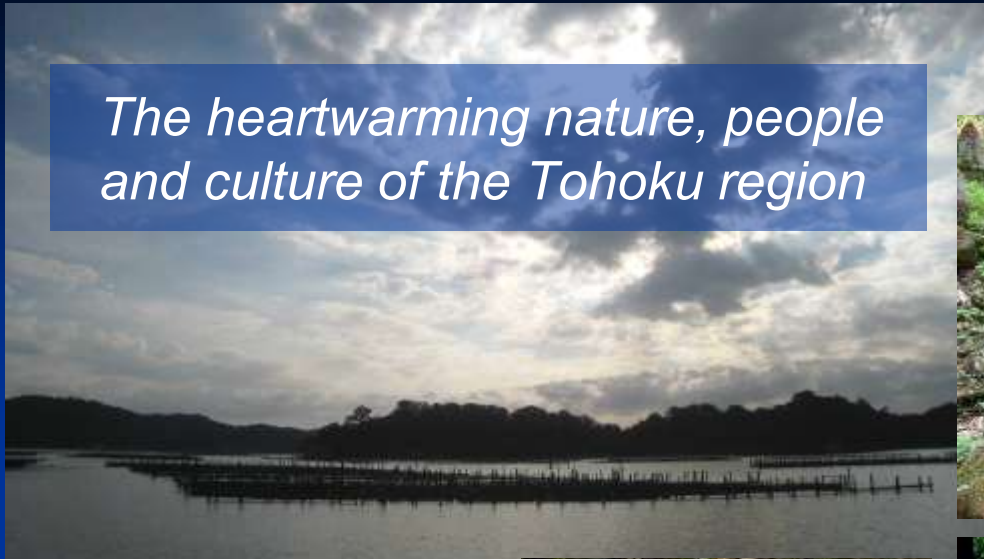
Sendai Airport area

A natural disturbance of unheard-of proportions



The drastic landscape change of Ido area, a typical nature conservation site of the Sendai Bay sand-dune coast (left: 2009, right: 2011)

The heartwarming nature, people and culture of the Tohoku region



Three Topics

- 1) Coastal ecotone: the case of the Sendai Bay sand-dune fringe
 - A transitional zone connecting the sea, land and river
 - A shifting formation of unstable, diversified and unique ecosystems
- 2) Surveys in the Minami-Gamou Monitoring Site
 - Monitoring design of the sand-dune coastal ecotone
 - Heterogeneity of earthquake/tsunami disturbance
 - Rapid autonomous recovery of unique wildlife and catenate-coastal ecosystems
- 3) How do we contribute to the sustainable community development through our research?
 - Importance of ecosystem service/resilience-based restoration
 - Nurse hot-spots of biodiversity for our future

1) Coastal ecotone: the case of the Sendai Bay sand-dune fringe

Two types of coasts



A transitional zone connecting the sea, land and river
A shifting formation of unstable, diversified and unique ecosystems

(<http://www.earth.m/20110312/1299897244/>)



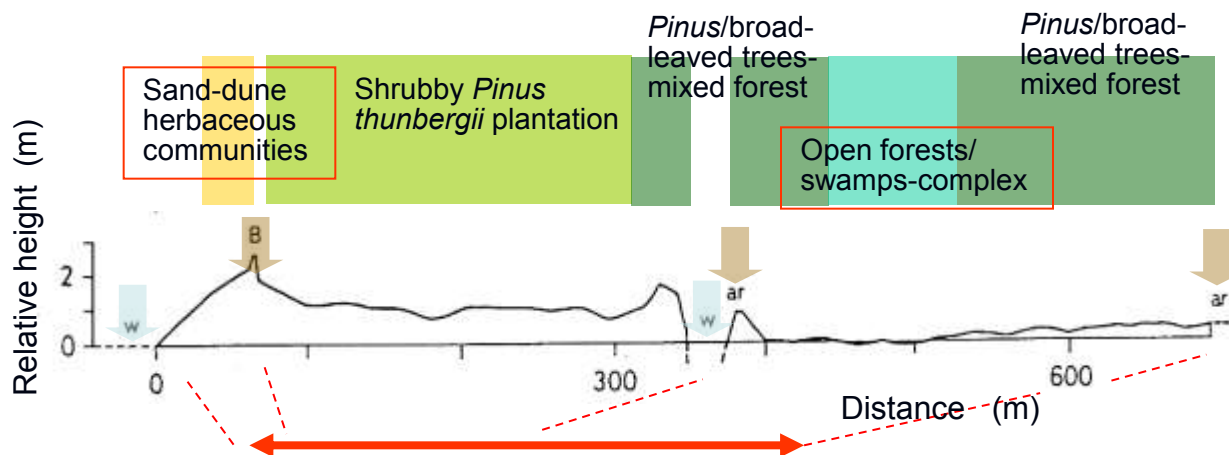
(Sendai Administrative Office, 1994)



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The ecotone-scale distribution of habitats, human impacts and vegetation in Ido area

Vertical view



(Google earth, 2011)

Vertical view

Natural and semi-natural vegetation



Vegetation and infrastructures under the severe human impacts



Shoreline



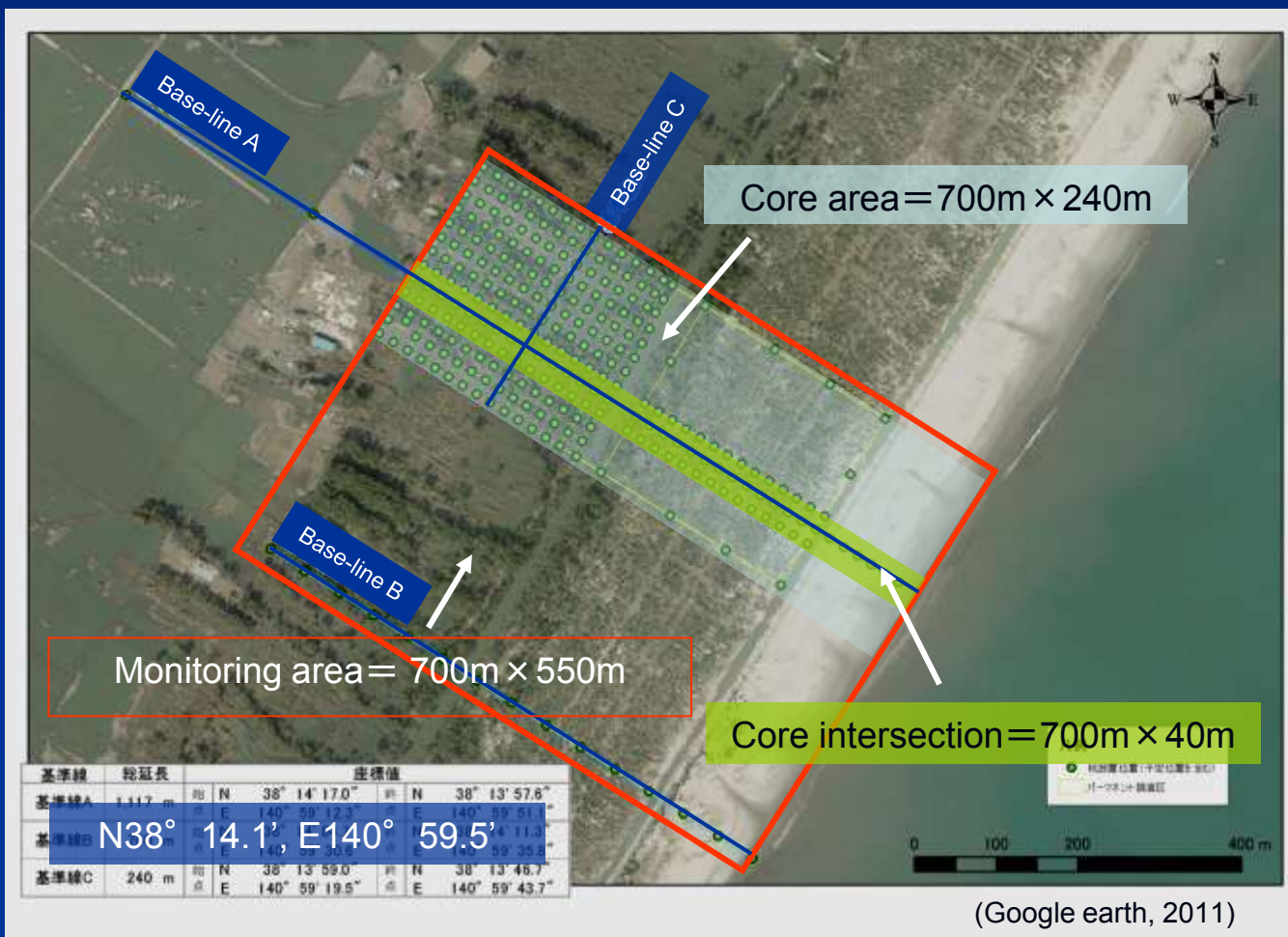
Alluvial plain

*Catenate-landscape along the environmental gradient
between the foreshore and the alluvial plain*

*Mosaic of vegetation assemblages in each catena-unit,
owing to natural and man-made disturbance regimes*

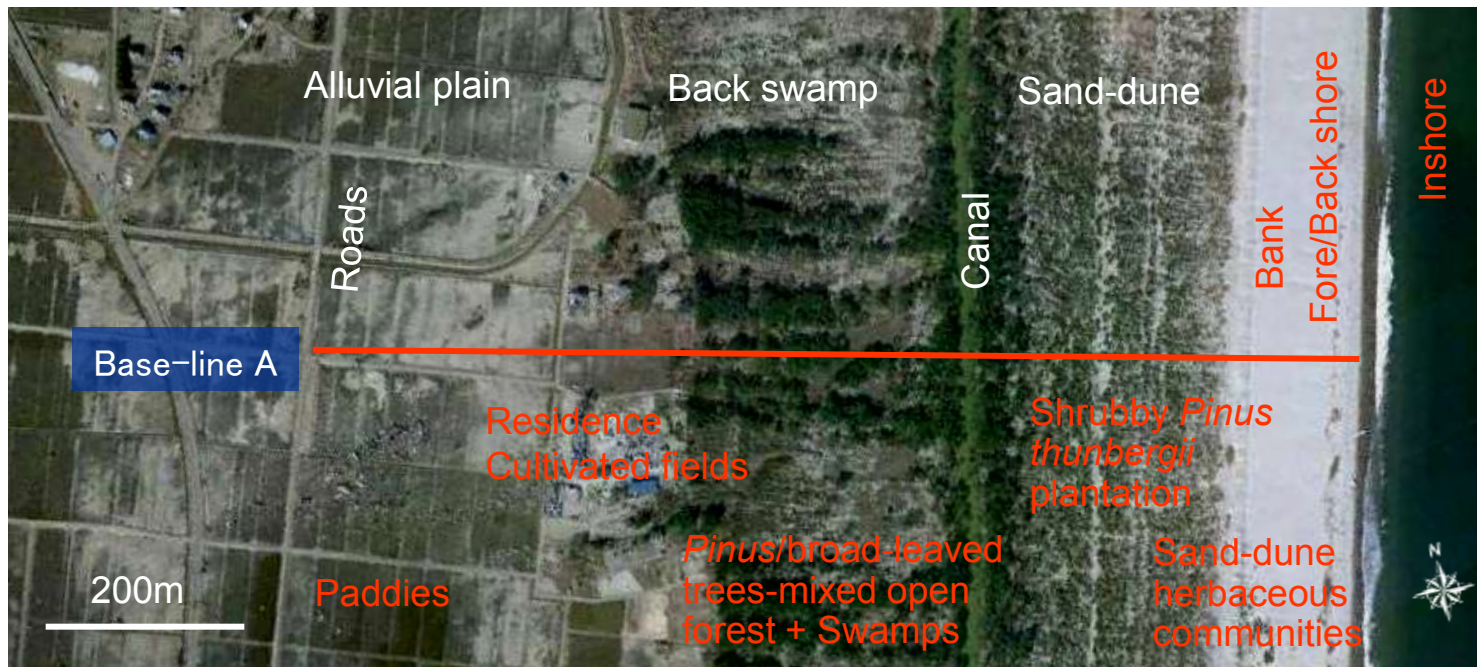
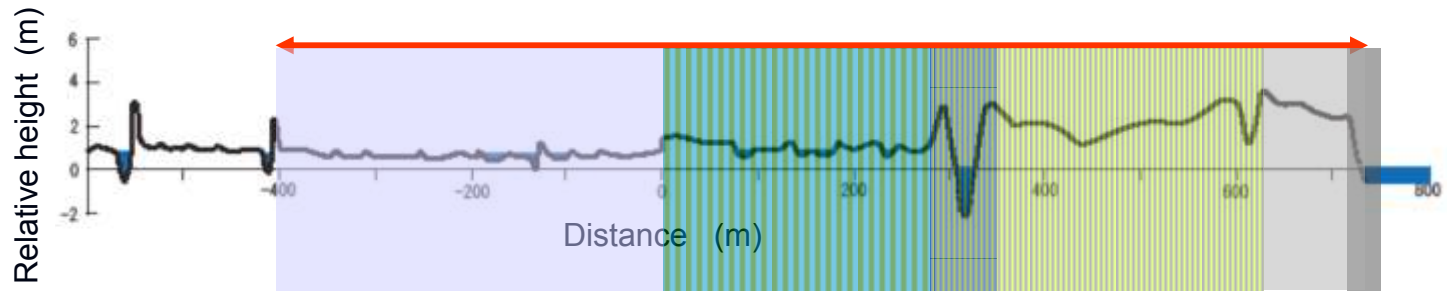
2) Surveys in the Minami-Gamou Monitoring Site

Monitoring design of the sand-dune coastal ecotone



Post-huge tsunami formation of micro-scale vegetation along the foreshore-alluvial plain gradient

An outline along the Base-line A



(Google earth, 2011)

Vigorous recovery of vegetation in the third growing season, 2013

(a) Sand-dune herbaceous communities on the flattened sand-dune



(b) Shrubby Pinus thunbergii plantation on the flattened sand-dune



*(c) Swamp communities on the patchy-disturbed back swamp
(lower ground-level micro-site)*



(d) Pinus/broad-leaved trees-mixed open forest on the stripy/patchy-disturbed back swamp (higher ground-level micro-site)



3) How do we contribute to the sustainable community development through our research?

Species and habitats of the coastal vegetation, namely companions and the foundation of the local ecosystems, suffered severe damage



(Google earth, 2011)

Catastrophic event !? Even so, many companions of the coastal ecosystems survived and began to recover rapidly



beach



(by Goukon)



forest



(by Hiraizumi)



(by Suginome)



marsh



dune



grassland



(by Goukon)



Extensive denudation and land reclamation has occurred along the Sendai Bay sand-dune fringe



Huge loss of native species, habitats, landscapes and ecosystem services caused by the coastal forest reconstruction project





*Powerful, rapid and poorly coordinated restoration projects
covering over the coastal ecotone*



Integrated coastal management

*An urgent issue is to build up the strategic ground-
design for preserving and connecting typical
ecotone sites along the Sendai Bay coast*

- Nurse hot-spots of biodiversity*
- Protect the mechanism of autonomous recovery
and bio-shield against disasters*

Ecosystem service/resilience-based restoration



From Tohoku, thank you very much !