

# ASSOCIATION OF COASTAL TOPOGRAPHY WITH THE DISTRIBUTION OF COASTAL PLANT COMMUNITIES AND OTHER ENVIRONMENTAL COMPONENTS ON IKINOMATSUBARA COAST, FUKUOKA, JAPAN

Kyushu University, Student Member, ○Yawen SONG  
Kyushu University, Regular Member, Satoquo SEINO

## 1. INTRODUCTION

A large number of coastal plants are distributed along the Ikinomatsubara Coast, and each area has a different dominant population. The formation of coastal microtopography is not only related to the distribution of coastal plant communities but also closely related to the distribution of sand grain size, wind velocity, wind volume, tidal movement, etc. The data collection of various environmental components is essential to grasp the topographic characteristics of the Ikinomatsubara Coast. In this research, we investigated the connection between coastal microtopography and the distribution of

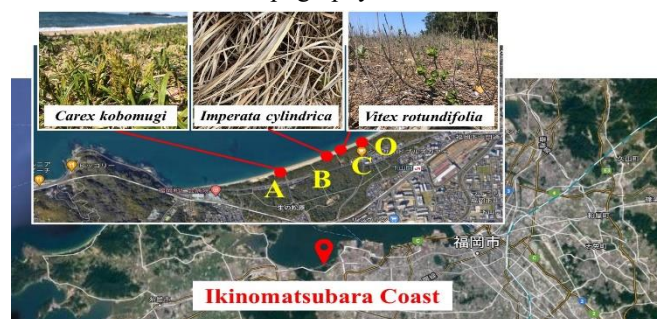


Fig. 1 Survey sites and dominant coastal plant populations in each area

coastal plants and other environmental factors by conducting field surveys and studies in three groups of A, B, and C with different dominant coastal plant communities and a control area O without any coastal plant distribution.

## 2. RESEARCH METHODS

Measurement lines were set up from the shoreline to the hinterland boundary in each observation area, and the topography of the coast was surveyed at one-meter intervals with RTK-GNSS. In addition, five observation areas were set up on Ikinomatsubara Coast. A, B and C were coastal plant observation areas, each with different dominant plant communities, and O was the control area with zero density of coastal plant distribution. Wind velocity observation points were set up every one meter along the same measurement line, and real-time data were collected at the height of 0cm, 5cm, 10cm, 20cm, 30cm, 40cm, 50cm, 60cm, 70cm, 80cm, 90cm, and 100cm from the surface of each observation point by using Hot-wire Anemometer DT-8880 connected to computer analysis software. Then a square framing of 50×50cm was set at the center of each one-meter measurement point, and the coastal plant community was photographed with a COOLPIX P950 camera directly above, and then the coastal plant coverage within the framing was calculated by using Adobe Photoshop combined with the binarization method. Surface sand samples were collected along the measurement line and

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Contact address: 744 Motooka, Nishi Ward, Fukuoka, 819-0395, Japan, Tel: +81-92-802-3437

in the same position as the square framing, and then brought back to the laboratory and dried at 70°C for 12 hours or more. The dried sand samples were sampled again by the quadrat method (100±0.5g) and then sieved into seven classes: above 2mm, 2mm~1mm, 1mm~850μm, 850μm~425μm, 425μm~250μm, 250μm~106μm, 106μm~75μm, and below 75μm. The sieving amplitude was 50 rpm and the duration was 10 minutes.

## 3. RESULTS AND DISCUSSION

### 3.1 Characteristics of coastal topography and plant community distribution

Among the four observation areas of A, B, C, and O, the first three are coastal plant community distribution areas, and the dominant coastal plant species in the community are *Carex kobomugi*, *Imperata cylindrica*, and *Vitex rotundifolia*. From Fig. 2, it can be seen that 1) the overall elevation of the coast in the control O area is lower than that of the other observation areas, and the change in microtopographic relief is also smaller than that of the other observation areas; 2) the coastal elevation at the endpoint of coastal plant distribution in the three observation areas of A, B, and C are significantly decreased. The above demonstrates the role of coastal plants in maintaining coastal topography.

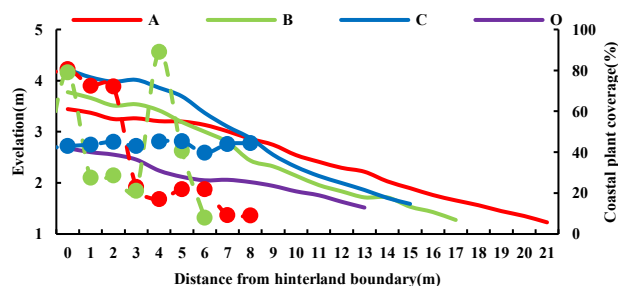


Fig. 2 Microtopography and the Distribution of Coastal Plant Communities on the Ikinomatsubara Coast

### 3.2 Association of coastal topography with the distribution of coastal plant communities and other environmental components on the coast

The dominant coastal plant community in area A is *Carex kobomugi*. It has well-developed underground stems that grow upward and spread laterally as it burrows into the sand. The subterranean stems allow the sand to accumulate easily, the plant height in winter was about 5 cm, and the distribution of coastal plants was concentrated in the range from 10 m away from the shoreline to the hinterland boundary line, and the plant coverage showed a decreasing trend from the hinterland boundary to the 10 m point, and the decrease in terrain height was greater at the 10 m point. The instantaneous

wind velocity was nearly cyclical, and the measured wind speed increased significantly with the height of the measured point, and the lowest wind speed was at 0~5cm from the ground surface. From the hinterland boundary to the coastline, with 850  $\mu\text{m}$  as the boundary, the proportion of sand grains larger, than 850  $\mu\text{m}$  becomes smaller and smaller, and the proportion of sand grains smaller than 850  $\mu\text{m}$  changes in an inverse relationship. The dominant coastal plant community

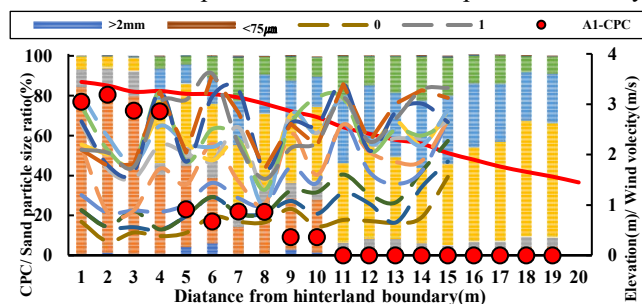


Fig. 3 Influence of coastal plant community distribution and other environmental components on coastal topography in area A

in area B is *Imperata cylindrica*, long, white, conspicuously nodular underground stems that creep horizontally, reproduce by producing fine roots, and produce a small number of leaves in clusters from several places. The plant height in winter was about 50 cm, and the distribution of coastal plants was concentrated in the range from 9 m away from the shoreline to the hinterland boundary, and the plant coverage showed a decreasing trend from the boundary line to the 9 m points, and the decrease in topographic height was larger at the 9 m point.

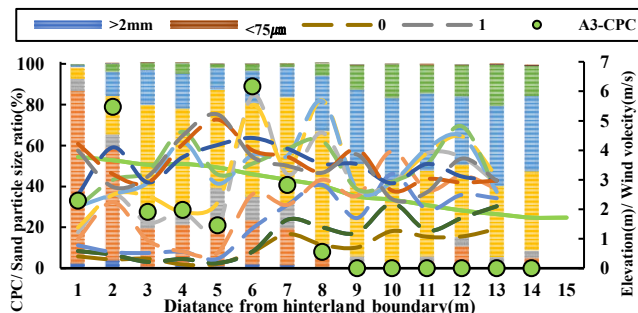


Fig. 4 Influence of coastal plant community distribution and other environmental components on coastal topography in area B

The variation of the periodicity of the instantaneous wind speed is not obvious, but the measured wind speed still increases significantly with the height of the measured point, and the wind speed is lower below 50 cm from the ground surface. The variation of the percentage of sand grains of each particle size is similar to area A. The dominant coastal plant community in area C is *Vitex rotundifolia*, stems crawl on the ground and grow half-buried in the sand. The plant height in winter was about 20 cm, and the leaves almost all fell off. The distribution of coastal plants was concentrated in the range from 10 m away from the shoreline to the hinterland boundary, and the plant coverage hardly changed from the boundary line to the 10 m point, but the decrease in topographic height was larger at the 10 m point. The instantaneous wind speed varied approximately periodically, and the measured wind speed still increased significantly with the height of the measurement point and was lower below 20 cm from the ground surface. The variation in the percentage of sand grains of each particle size is similar to the first two observed areas. There is no

coastal plant distribution at observation site O and the change

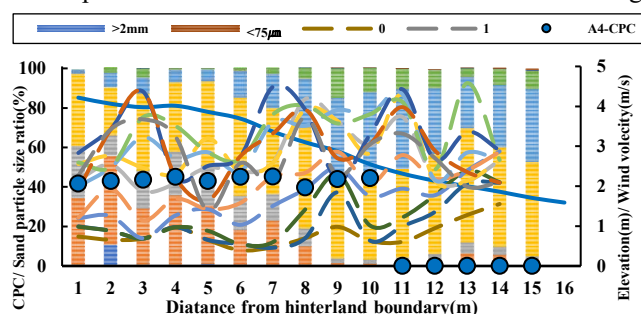


Fig. 5 Influence of coastal plant community distribution and other environmental components on coastal topography in area C

of coastal elevation is not obvious. The instantaneous wind speed also does not show a periodic change, but the measured

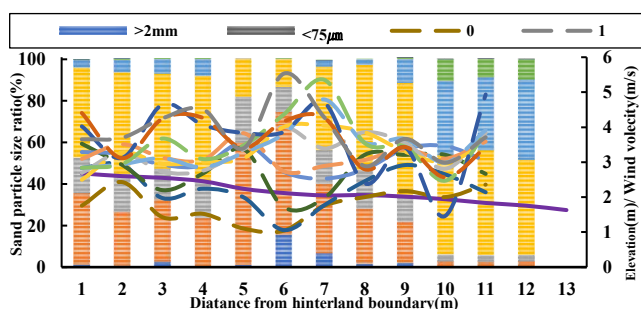


Fig. 6 Influence of coastal plant community distribution and other environmental components on coastal topography in area O

wind speed still increases significantly with the change in the height of the measurement point. The proportion of sand grains of each grain size varied from the area with coastal plant distribution, and the proportion of sand grains larger than 850  $\mu\text{m}$  peaked in the middle of the observation area and then gradually decreased, which was still inversely proportional to the proportion of sand grains smaller than 850  $\mu\text{m}$ .

#### 4. CONCLUSION

The coastal plant communities have the function of wind and sand control, and the coastal plant communities with different dominant populations have different effects on the shaping of coastal topography. In the distribution area of the coastal plant community, the wind speed below the average height of the plant community is slower, which is beneficial to the accumulation of sand particles, the coastal topography is higher, and the average particle size of sand particles in the higher topography area is larger than that in the lower topography area.

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