Factors influencing the distribution of two co-occurring dwarf bamboo species (*Sasa kurilensis* and *S. senanensis*) in a conifer-broadleaved mixed stand in northern Hokkaido

Mahoko Noguchi, Toshiya Yoshida(2004)

発表者:木島壮太

Sasa kurilensis and *S. senanensis*

- Snowfall is the most important factor structuring the distribution of dwarf bamboo species in cool temperate regions.
- *S. kurilensis* tend to dominate with heavier snowfall than *S. senanensis* because of the diffrence in height of winter buds on their culms; *S.kurilensis* produce buds higher on culms.

Sasa kurilensis and *S. senanensis*

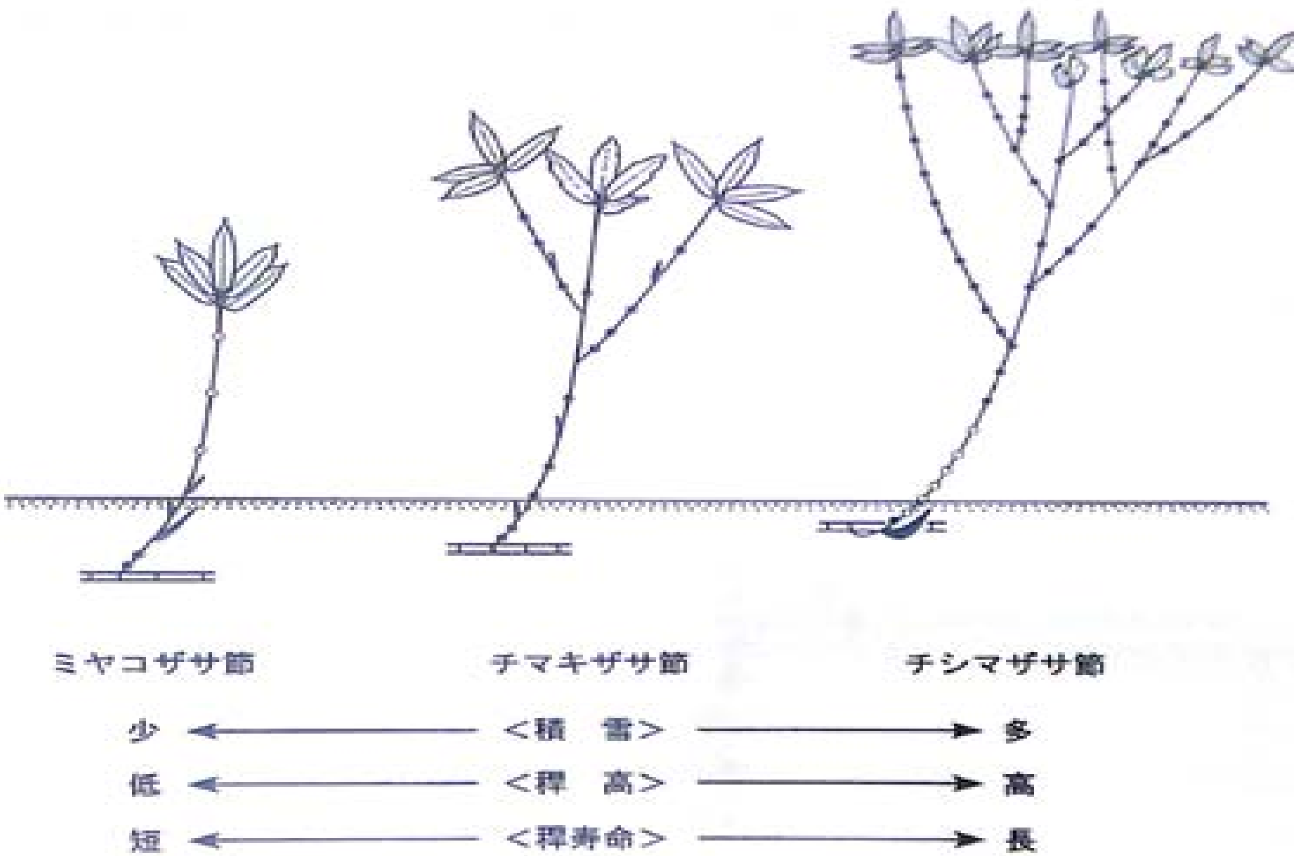
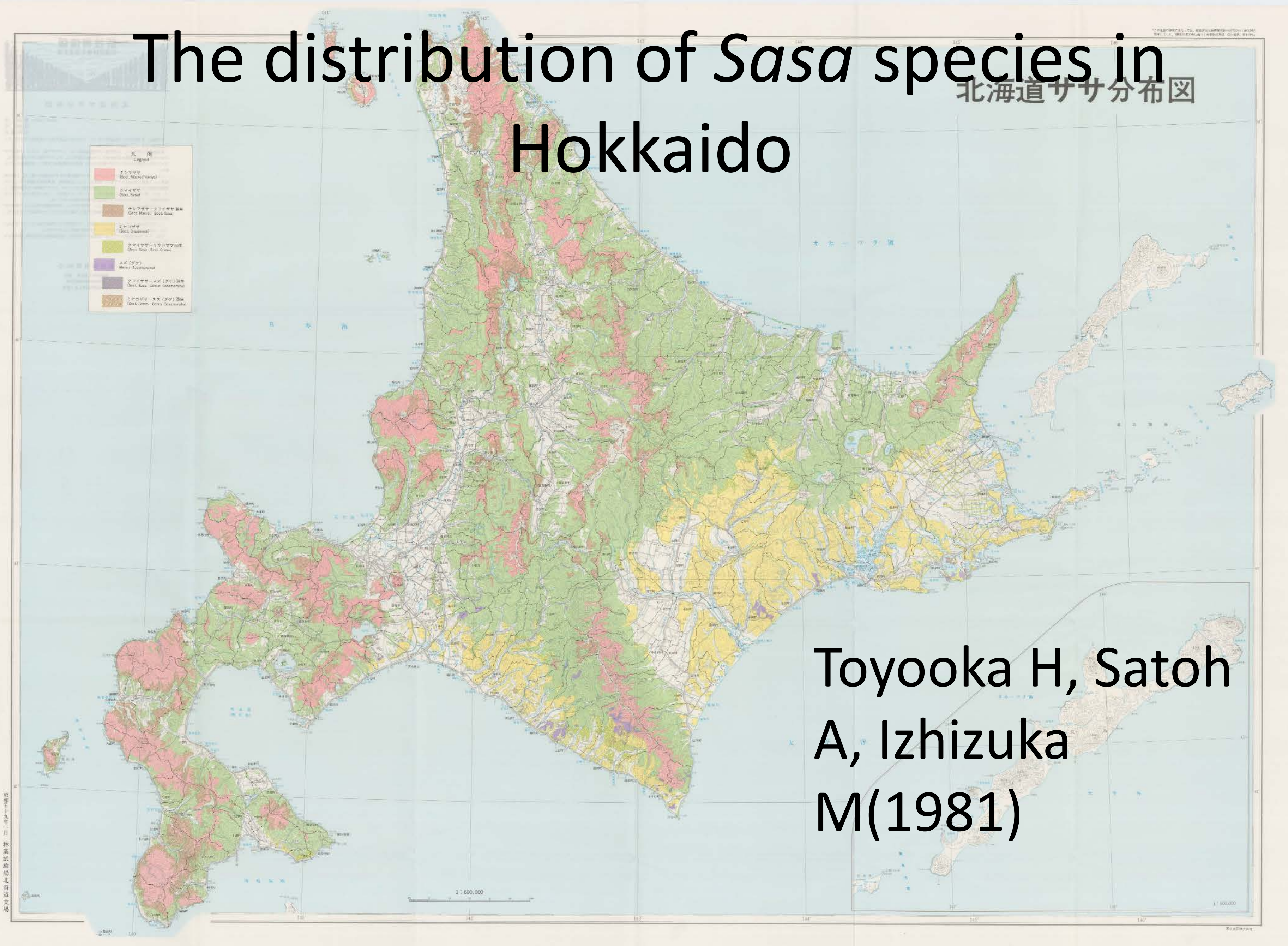


図 10.27　主なササの形態的特性と分布との関係（文献 164 を改変）

蒔田明史.樹木生理生態学(2004) p.201

The distribution of *Sasa* species in Hokkaido



Toyooka H, Satoh A, Izhizuka M(1981)

Objective of this study

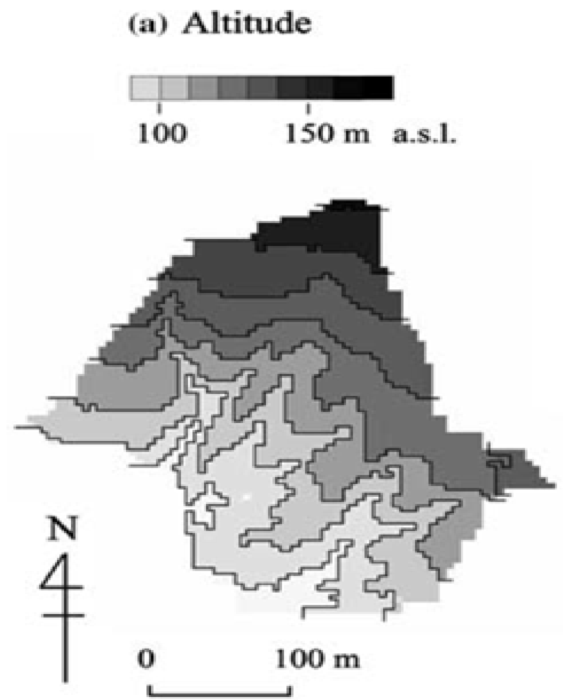
- The distribution of these two species is not always clearly divided within region and they sometimes occur together within the same stand.
- Then what influencing the distribution of this co-occurring ?

Methods(study area)

- Study area: A conifer-broadleaved mixed stand in Nakagawa Experimental forest of Hokkaido University.
- The overstory of the stand is dominated by *Abies sachalinensis*, *Quercus crispula*, *Betula ermanii*, *Acer mono*.
- Though the stand has been managed with selection cutting, the effect of logging on understory vegetation is small due to the logging carried out in winter.

Methods(study area)

- The topography is characterized by small ridges and valleys.



Methods(Measurement item)

- The culm density and height were recorded separately for *S. kurilensis* and *S. senanensis* in 168 circular plot(3.14m^2
- Probable factors; snow depth(recorded on 20 April), slope, curvature, hillshade, overstory condition.
- A digital elevation model(DEM) was used to measure slope, curvature and hillshade.

Result

- The plots were divided into *S. kurilensis* dominated plots and *S. senanensis*.
- The plots were generally occupied overwhelmingly by one species.

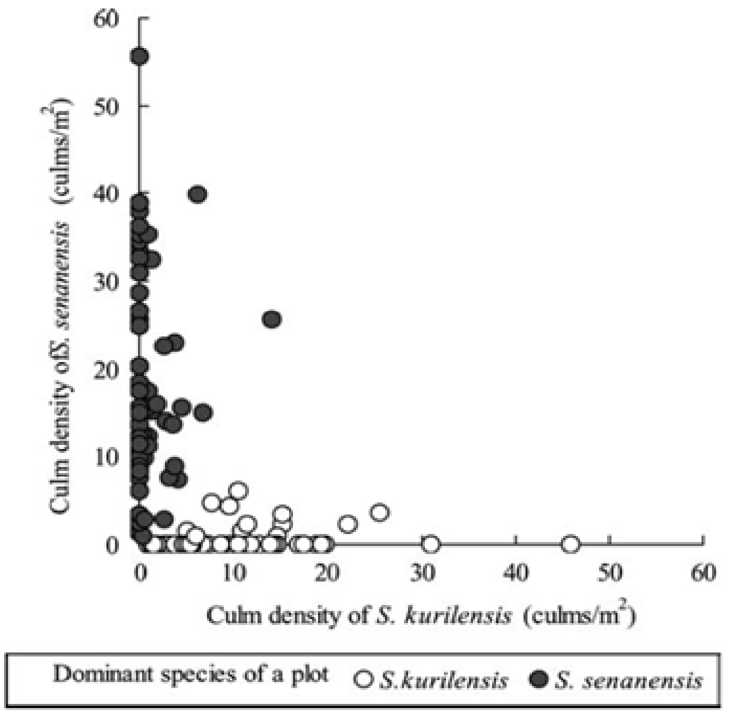
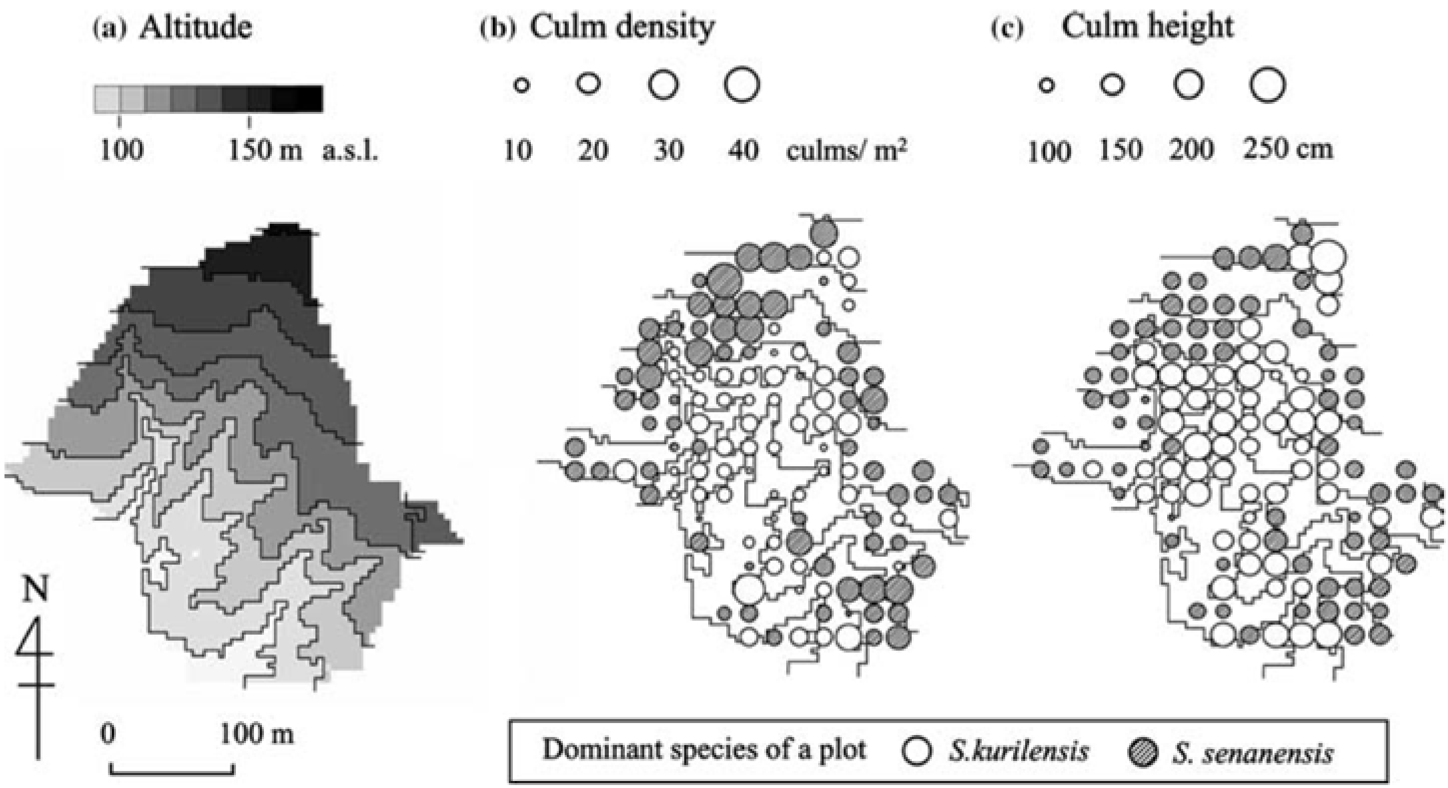


Fig. 2 Culm density of *Sasa kurilensis* and *S. senanensis* in the plots. *Open and shaded circles* indicate the plots dominated by *S. kurilensis* and *S. senanensis*, respectively



- The plots dominated by each species tended to show aggregated distribution.
- *S. kurilensis* dominated in narrow ridges and valleys, while *S. senanensis* in wide ridges and flat slopes.

Table 1 Results of stepwise linear discriminant analysis. Values are standardized coefficients of linear discriminant function. The other variables (hillshade, initial BA and BA increment of conifers and broadleaved trees) were not selected by the stepwise method

Independent variables	Standardized coefficient
Remaining snow depth	0.436
Slope	0.927
Curvature	0.407

- Slope was the most important of these variables(0.927).
- The linear discriminant function correctly predicted dominant species in 71.7% of plots.

Table 2 Comparisons of independent variables (mean and SD in parentheses) between plots dominated by the two dwarf bamboo species (*Sasa kurilensis* and *S. senanensis*)

	Dominant species		P^{a}
	S. kurilensis (n = 58)	*S. senanensis* (n = 69)	
Remaining snow depth (cm)	20.1 (20.3)	14.5 (15.4)	0.137
Slope [tan(slope angle)]	0.6 (0.3)	0.4 (0.2)	<0.001
Curvature	1.3 (15.0)	−2.6 (10.6)	0.106
Hillshade	210.1 (43.2)	221.3 (23.7)	0.659
Sum of BA (m^2/ha)			
Conifers	11.0 (11.1)	13.3 (12.7)	0.430
Broadleaved trees	13.8 (11.9)	12.0 (11.1)	0.318
Change in BA (m^2/ha/30years)[b]			
Conifers	4.0 (12.6)	5.0 (11.2)	0.643
Broadleaved trees	6.4 (10.3)	7.9 (10.1)	0.737

[a] Results of Mann-Whitney U test

[b] A positive value indicates that the sum of basal area of growth and recruitment exceeds that of dead stems

- The mean slope was significantly steeper in the *S. kurilensis* dominated plots than in the *S. senanensis* dominated plots.
- Remaining snow depth and curvature had a tendency to be higher in the *S. kurilensis* dominated plots than in the *S. senanensis* dominated plots.

Table 3 Results of stepwise multiple regression analysis, conducted separately for *Sasa kurilensis* and *S. senanensis*, using the data from the dominant plots for each. Standardized coefficients (with *P* values in parentheses) for the selected variables, *P* value of the model and r^2 are shown for each model

		Remaining snow depth	Slope	Curvature	Hillshade	Initial BA		Change in BA		*P*	r^2
						Conifer	Broadleaved	Conifer	Broadleaved		
Culm density	*S. kurilensis*	–	–0.264 (0.045)	–	–	–	–	–	–	0.045	0.053
	S. senanensis	–	–0.325 (0.008)	–	–	–0.199 (0.097)	–	–	–	0.016	0.091
Culm height	*S. kurilensis*	–	–0.283 (0.035)	–	–	–0.284 (0.032)	–	–0.328 (0.011)	–0.213 (0.095)	0.010	0.159
	S. senanensis	0.224 (0.056)	–0.261 (0.018)	–	0.353 (0.003)	–0.280 (0.012)	–	–0.393 (<0.001)	–0.354 (0.001)	<0.001	0.413

- The culm density and height of both species decreased significantly with slope.
- Change in BA of both of conifer and hardwood had negative effect on the culm height.
- Hillshade was important for *S.senanensis*.

Discussion

- Slope and curvature are closely related to soil properties such as moisture and soil depth, so that the physiological and morphological preferences of two species are involved.
- The below ground structure differs between dwarf bamboo species.
- Snow depth in April seem to be more important to determine the distribution of two species than that in winter.

- BA of conifers had a strong effect on culm height. Therefore, physiological integration within a clonal fragment is important for dwarf bamboo, espetially *Sasa senanensis* whichi more sensitive to light environment.
- The study is necessary that the indirect effects of physiological environments determining dominant dwarf bamboo species is taken into account.

Question

- Why *S. kurilensis* dominate in sub-alpine region, but not *S. senanensis*

  →*S. kurilensis* is more adaptable for different environment than *S. senanensis*?