Effects of *Sasa* mass-flowering and dieback on forest tree regeneration: Preliminary results from a seedling survey (2024-2025) in the Nakagawa Experimental Forest

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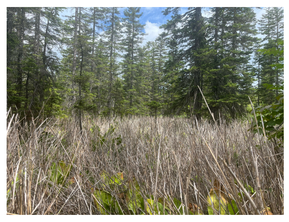
Introduction



Flowered

Non-flowering

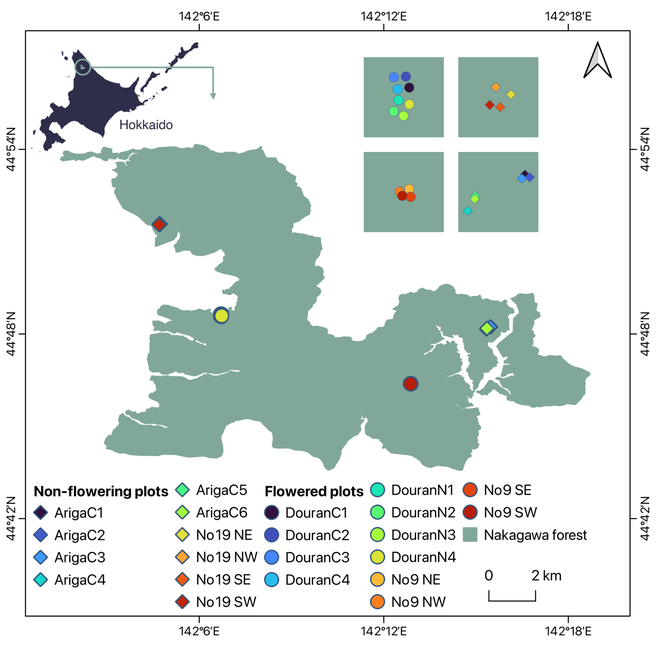


Figure1. Location of the study plots in Nakagawa

- Between 2022 and 2023, a rare phenomenon of synchronous flowering followed by mass mortality occurred in widespread populations of *Sasa* sect. *Sasa* (クマイザサ) in Hokkaido, Japan[1].
- The mass dieback of *Sasa* following synchronous flowering abruptly breaks decades of understory suppression, opening a crucial 'window of opportunity' for forest regeneration[2].
- **Aims:** Quantify the impacts of *Sasa* dieback on forest regeneration: the recruitment of new seedlings and the growth release of pre-existing ones.

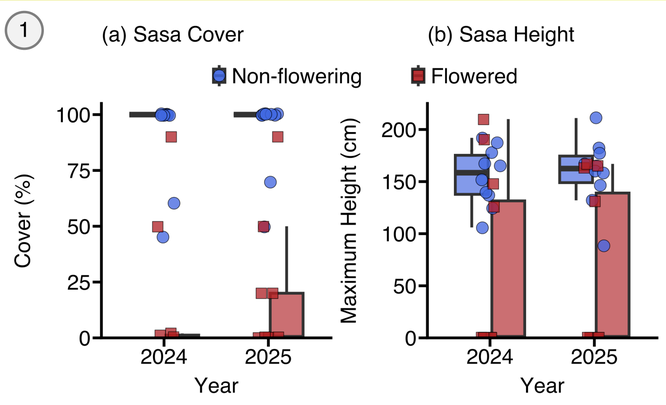
Methods

- **Time:** September 2024; September 2025
- **Plot size:** 2 × 2 m
- **Number of plots:** 12 flowered plots + 10 Non-flowering plots
- **Field survey content:**

Cover (%)	*Sasa*, Herbaceous, Vine
Canopy (%)	Tree canopy openness
Number of individuals	Tree seedling, *Sasa* seedling
Seedling species	Tree seedling
Height (cm)	Maximum *Sasa* height Height of seedlings > 20 cm

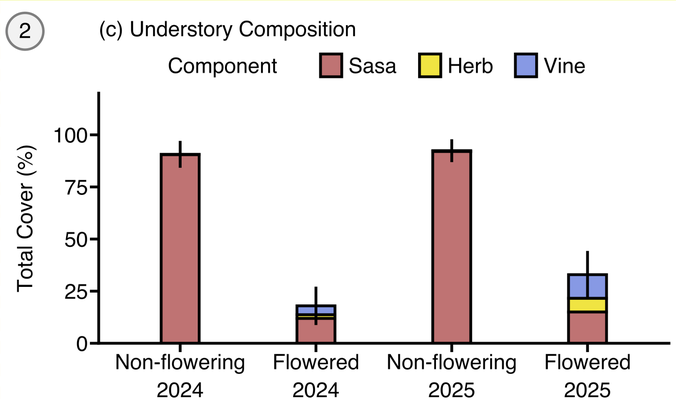
- **Statistical Analysis:**
- Two-way analysis of variance (ANOVA)[3]
- Linear Mixed-Effects Model, LMM
- Shannon diversity index[4]
- Non-metric Multidimensional Scaling, NMDS[5]

Results



Treatment:
Sasa cover ($p < 0.001$)
Sasa height ($p < 0.01$)

Year:
Sasa cover ($p = 0.080$)
Sasa height ($p = 0.980$)

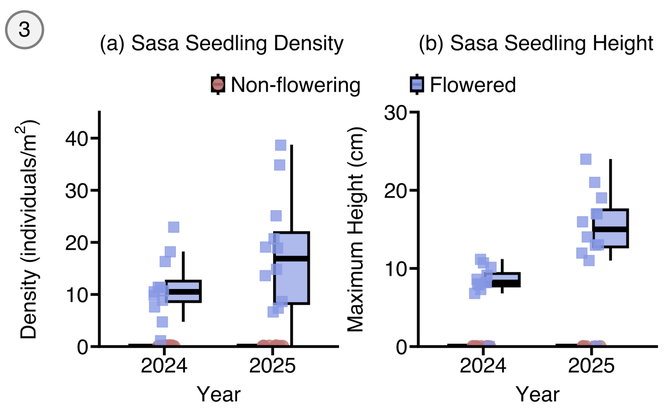


Non-flowering sasa cover (2024 vs 2025): $p = 0.371$

Flowered sasa cover (2024 vs 2025): $p = 0.371$

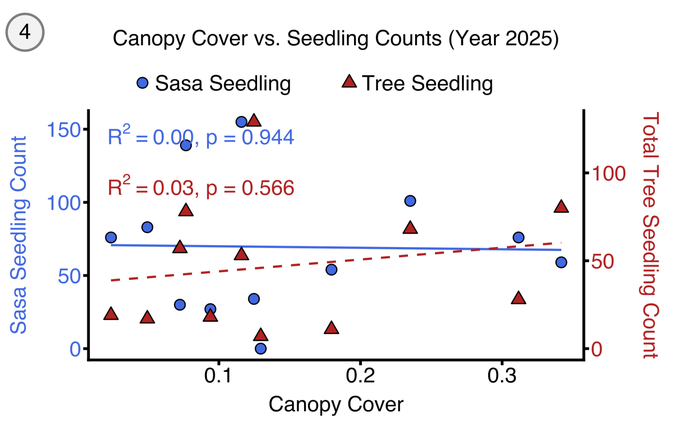
Flowering herb cover (2024 vs 2025): $p < 0.05$

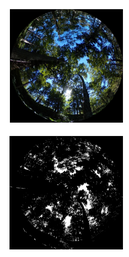
Flowered vine cover (2024 vs 2025): $p = 0.06$



2024:
Flowering effect $p < 0.001$
Year effect $p < 0.05$

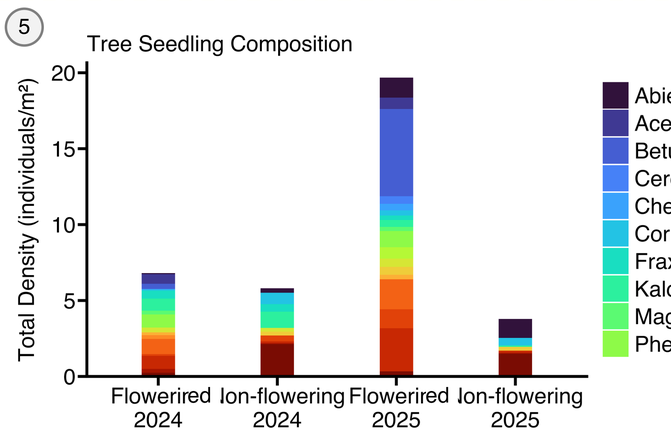
2025:
Flowering effect $p < 0.001$
Year effect $p < 0.001$





Canopy Equal-Area Projection Image

Canopy Binary Image

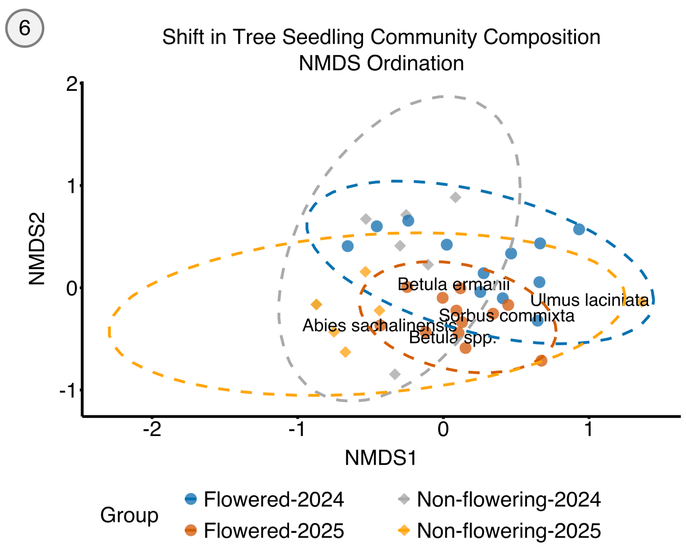


Flowered area (2024 to 2025)

Shannon diversity	+0.365
Fastest growing species	*Betula ermanii* (+11.625 individuals/m²)

Non-flowering area (2024 to 2025)

Shannon diversity	-0.256
Fastest growing species	*Abies sachalinensis* (+0.95 individuals/m²)



NMDS Stress: 0.175.
The overall trend is reliable.

PERMANOVA: $R^2 = 0.199$, $p = 0.001$
The grouping variable explains 19.9% of the total community variation. In a complex ecosystem, this is a considerable explanatory power.
There is a statistically highly significant difference in tree seedling community composition among the four group (Flowering-2024, Flowering-2025, Non-flowering-2024, Non-flowering-2025).

Flowering group
Between 2024 and 2025, the community composition of this group underwent a fundamental change. This change was primarily driven by the outbreak of specific species, such as *Betula ermanii* and *Sorbus commixta* appeared in large numbers in 2025, reshaping the seedling community in the "Flowering" area.

Non-flowering group
The seedling community under this treatment exhibited a high degree of stability, with no significant change between the two years.

Conclusions

1. Followed *Sasa* dieback, herbaceous plants and vines rapidly colonized the vacated ecological niche.
2. In the initial phase of regeneration, tree and sasa seedling establishment was independent of the canopy.
3. *Sasa* dieback triggered a burst of tree seedling establishment, primarily driven by Erman's birch (Betula ermanii, which increased by +11.625 individuals/m²). Concurrently, the Shannon diversity of the seedling community in this area also increased.
4. The tree seedling community composition in the flowering areas underwent a fundamental shift.

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Contact

Who am I: I am a first-year doctoral international student from China, and my research topic is the changes in the ecological effects of *sasa* before and after flowering.

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