Spatial and temporal variation of species composition and structure of unmanaged secondary forest (abandoned *satoyama*) adjacent to late-successional forest

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Introduction

There are several ecological issues associated with unmanaged secondary forests, or abandoned ***satoyama***, in Japan, such as decreasing species diversity and invasion by alien species. To understand its vegetation dynamics, we investigated change in species composition and stand structure of an unmanaged secondary forest over 15-years.

Methods

- **Measurements:** From 2005-2020, we measured species, diameter at breast height (DBH), height of all trees taller than 1.3 m.
- **Analysis:** To compare species composition and stand structure among the plots, we used nMDS (non-Metric Multidimensional Scaling) analyses based on Bray-Curtis similarity indices calculated using abundance and basal area (BA).

Result & Discussion

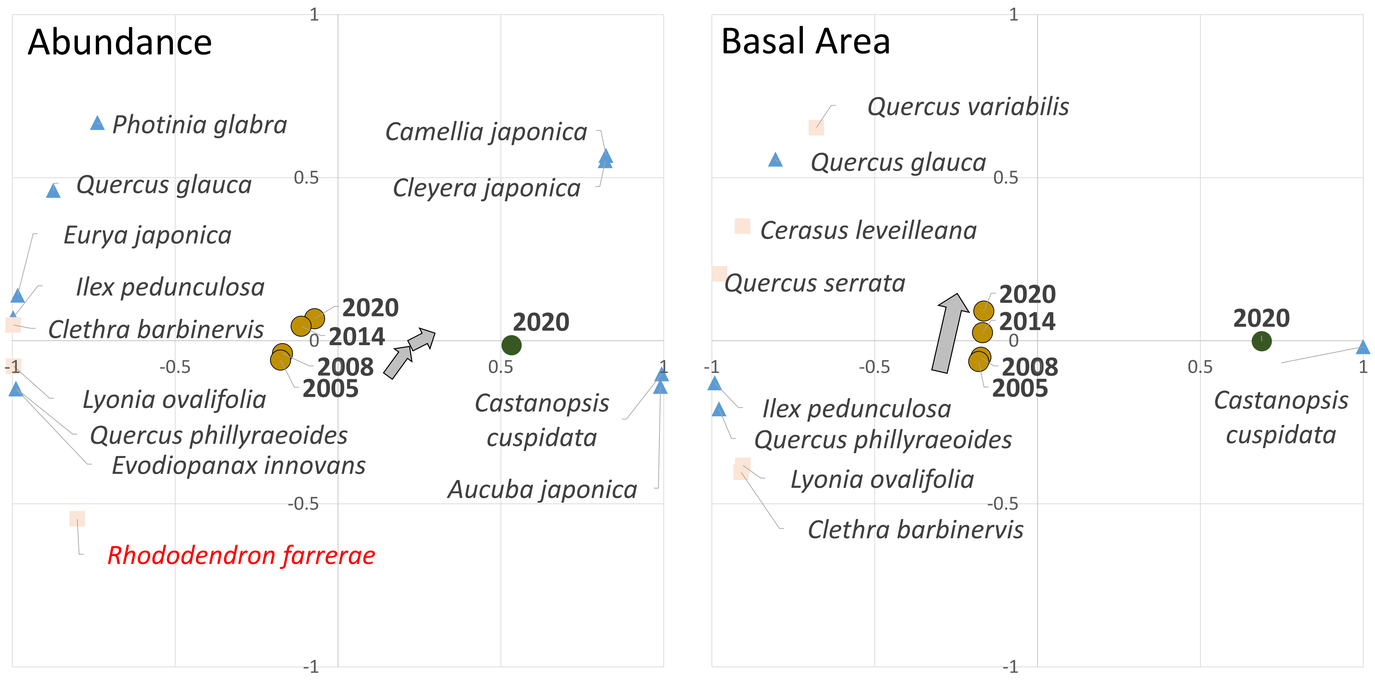

Fig. 3 Results of nMDS analyses using Bray-Curtis similarity indices showing change in abundance and basal area of the secondary forest plot (●) from 2005 to 2020 in relation to those of lucidophyllous forest plot in 2020 (●). Coordinates of each species (▲evergreen and ■deciduous trees) reflect correlations with each axis.

- **Over the 15-year study period, species composition of the lucidophyllous forest was stable, while that of the secondary forest approached the lucidophyllous forest.**
  This was due to decreasing abundance of shade-intolerant species, such as ***Rhododendron***, whose abundance tends to decrease as succession proceeds (Morimoto and Yoshida, 2005).

- **Stand structure of the lucidophyllous forest was stable, while that of the secondary forest did not approach the lucidophyllous forest.**
  This was because dominant canopy trees, namely ***Quercus serrata*** and ***Quercus variabilis***, continued to grow in the secondary forest. Although late-successional species are regenerating in the secondary forest, it may take several decades for the stand to reach late-successional structure similar to the lucidophyllous forest where evergreen broadleaved trees, namely *Castanopsis cuspidata*, dominate the canopy.

Study site

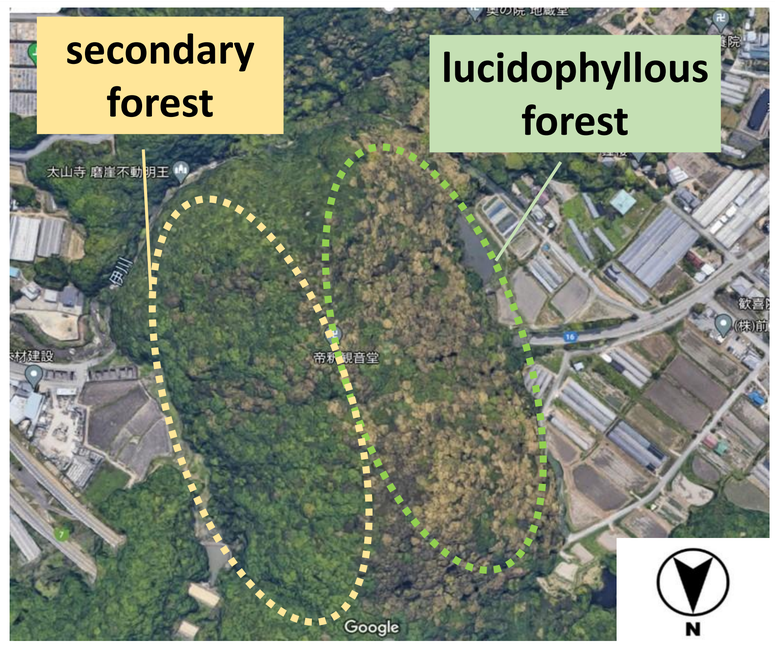

Fig. 1: The study site is located within the grounds of a 1300-year-old temple, Taisanji in Hyogo Prefecture, Japan. The late-successional, **lucidophyllous forest** is protected for religious reasons and there is no evidence of stand disturbance by human impact. In contrast, the **secondary forest** was cut regularly to obtain fire-wood until ca. 60 years ago, after which it was abandoned.

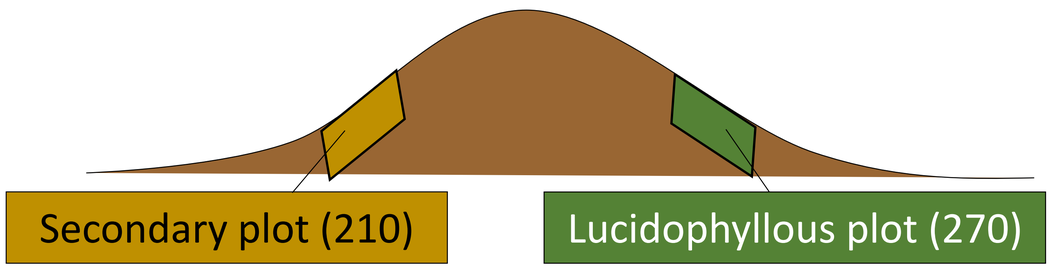

Fig. 2: Study plots were established in the **secondary** and **lucidophyllous** forests along the gradient from early- to late-successional vegetation. Numbers in () indicate plot size (m^2).

Conclusion

- Late-successional evergreen species are migrating from the **lucidophyllous forest** into the **secondary forest** resulting in a vegetation gradient.
- Although species composition of the **secondary forest** is approaching that of the **lucidophyllous forest** as succession proceeds, it may take several decades before stand structure reaches late-successional state.
- nMDS analyses allowed visualization and prediction of the direction and time-lapse of secondary succession of unmanaged *satoyama*.

References

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Acknowledgments

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