Species Abundance Distribution of Forest Communities in Zhejiang Longwang Mountain and Its Relationship with Altitude: Postprint

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Abstract

Although numerous studies have employed model fitting approaches to fit various mathematical models to the species abundance distribution (SAD) of plant communities, research on how SAD shape (curve skewness) changes continuously along environmental gradients remains insufficient. Particularly for forest communities, whether model fitting and shape variation of SAD are consistent across different vegetation types within the same region still lacks clear conclusions. This study focused on the main forest vegetation types distributed in the Anji Xiaoni National Nature Reserve, using the quadrat survey method to record species composition and individual abundance in 28 quadrats of 20 m × 20 m. By fitting SAD curves in the quadrats using the log-series and log-normal models to select the optimal model, and utilizing the α value in the Gambin model and the value in the Weibull model to reflect SAD shape, as well as the λ value in the Weibull model to reflect SAD scale (the degree of difference in individual abundance among species), the relationships between elevation and SAD shape and scale were analyzed. The results showed: (1) The species abundance distribution of forest communities in this region primarily conformed to the log-series model. (2) When all quadrats were included, the α and values showed no significant correlation with elevation, while the λ value exhibited a significant positive correlation with elevation. (3) For different vegetation types, the α and values showed a negative correlation with elevation in evergreen and deciduous broad-leaved mixed forests, but in deciduous broad-leaved forests, the λ value showed a positive correlation with elevation, while the α and values showed no significant correlation with elevation. These results indicate that the relationship between SAD shape variation and elevation differs among vegetation types, suggesting that the influence of elevation on species abundance distribution varies across different vegetation types. Therefore, in studies on species abundance distribution of plant communities and its relationship with influencing factors, it is necessary to consider distinguishing different vegetation types.

Full Text

Species Abundance Distribution Patterns and Their Relationship with Altitude in Forest Communities of Longwangshan, Zhejiang Province

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Abstract

Although numerous studies have fitted various mathematical models to the species abundance distributions (SADs) of plant communities, research on how SAD shape (i.e., the skewness of SAD curves) changes continuously along environmental gradients remains insufficient. Particularly for forest communities, it is still unclear whether model fitting and shape changes of SADs are consistent across different vegetation types within the same region. This study focused on the main forest vegetation types in the Hynobius amjiensis National Nature Reserve. Using the quadrat survey method, we recorded species composition and individual abundance in 28 plots of 20 m × 20 m. We fitted the SAD curves in each plot using the logseries and lognormal models, selected the optimal model based on AICc, and calculated the α parameter in the Gambin model and the parameter in the Weibull model to reflect SAD shape. We also calculated the λ parameter in the Weibull model to reflect the scale of SAD (i.e., the range of observed abundances). The relationships between altitude and both the shape and scale of SAD were then analyzed. The results showed: (1) The logseries model provided a better fit to SADs than the lognormal model. (2) When all plots were included, there was no significant correlation between SAD shape (α and) and altitude, but a significant positive correlation existed between the λ value and altitude. (3) In deciduous and evergreen broad-leaved forests, there was a negative correlation between altitude and both α and values, while a significant positive correlation was found between the α value and altitude in deciduous broad-leaved forests. These results indicate that model fitting and shape changes of SADs along environmental gradients are related to the vegetation types of forest communities. Therefore, it is necessary to consider vegetation types when analyzing changes in SAD shape in plant communities.

Keywords: Subtropical forests, community structure, species abundance distribution, models, vegetation types, Longwangshan

Introduction

Species abundance distribution (SAD) has long been a topic of interest for ecologists since its inception, with research extending into conservation biology, applied biology, and biogeography. SAD integrates information on species richness and relative abundance within communities, serving as an important quantitative tool for ecological community analysis that provides additional insights into species abundance patterns, such as the proportion of common versus rare species. Consequently, analyzing SAD holds significant theoretical and applied value for understanding community assembly processes, species diversity conservation, and biodiversity management. Generally, species composition and abundance within communities are influenced by ecological processes including dispersal and colonization rates, extinction rates, environmental filtering or selection, and speciation. Previous research suggests that the shape of SAD curves, as reflected by fitted models, can indicate the influence of both neutral processes and niche-based processes. Among the most widely used models for fitting SAD curves are the lognormal model and the logseries model. In resource-poor, environmentally unstable communities, SADs typically conform to the logseries model due to the influence of neutral processes such as dispersal and ecological drift. In contrast, in resource-rich, relatively stable, and mature communities, SADs generally follow the lognormal model, primarily shaped by interspecific interactions and environmental filtering. In forest communities, climate factors drive the formation of different forest vegetation types. For instance, evergreen broad-leaved forests are mainly distributed in subtropical and tropical regions with higher temperatures and relatively stable climate conditions, while deciduous broad-leaved forests are found in environments with lower temperatures and greater climate variability. Although numerous theoretical studies have examined which models better fit plant community SADs, most have focused on a single vegetation type within a particular region, without considering differences in SADs among different forest vegetation types. For example, the lognormal model provided the best fit for the species abundance pattern of spruce-fir broad-leaved mixed forests on the northern slope of Changbai Mountain, while other studies found that different models performed differently at various spatial scales for subtropical evergreen broad-leaved forest communities. However, no consensus has been reached on which model best fits which vegetation type, limiting our understanding of the differences in species abundance distributions among forest vegetation types and their driving factors.

While using optimal SAD models to infer community assembly processes has long been controversial, recent developments have shifted SAD research from model fitting and tests of niche theory versus stochastic processes toward investigating shape changes in SAD across space and time and their influencing factors. A deeper understanding of SAD shape variation and its underlying mechanisms holds theoretical significance and may aid biodiversity management. However, empirical studies examining the ecological drivers influencing SAD shape in plant communities at spatial scales remain limited. At the global scale, studies have found that SAD shape for woody plants and dryland plants is significantly influenced by climate variability and environmental selection. Altitude gradients, as key drivers affecting forest community vegetation type changes through their influence on temperature and moisture, also significantly affect SAD shape variation. Forest vegetation type distribution is influenced by altitude gradients; for example, evergreen broad-leaved forests, evergreen coniferous forests, and mixed evergreen coniferous and broad-leaved forests are mainly distributed in low-altitude subtropical regions, while deciduous broad-leaved forests dominate high-altitude areas. However, some studies analyzing relationships between altitude and SAD shape have not distinguished among vegetation types, leaving a gap in systematic research on how altitude affects SAD shape changes in different vegetation types.

This study selected deciduous broad-leaved forests, evergreen coniferous forests, and mixed evergreen and deciduous broad-leaved forests in the subtropical Hynobius amjiensis National Nature Reserve in Zhejiang Province. We established permanent forest monitoring plots for each vegetation type and recorded species composition and individual abundance data. By fitting logseries and lognormal models and calculating model parameters that reflect SAD shape, we analyzed the relationship between SAD shape and plot altitude across different forest vegetation types. We aimed to address two scientific questions: (1) Are SAD model fittings consistent across different forest vegetation types? (2) How does SAD shape variation (curve skewness) relate to altitude in subtropical forest communities, and does this relationship differ among vegetation types?

1.1 Study Area

The Hynobius amjiensis National Nature Reserve (119°23 48 -119°26 38 E, 30°22 32 -30°25 12 N), formerly the Longwangshan Provincial Nature Reserve, is located in Anji County, northern Zhejiang Province, within the northern margin of mid-subtropical China. Adjacent to the Tianmu Mountain National Nature Reserve, it represents one of the most biodiverse regions in the Yangtze River Delta. The highest peak reaches 1,587.4 m, with pronounced vertical climate variation and distinct vertical vegetation distribution. Along the altitude gradient, a relatively complete range of natural vegetation types has formed, dominated by deciduous broad-leaved forests with oak species as common components and mixed evergreen and deciduous broad-leaved forests. Additionally, there are mid-altitude evergreen broad-leaved forests dominated by species such as *Quercus gracilis* and *Q. stewardiana*, as well as evergreen coniferous forests dominated by *Pinus taiwanensis* and mixed evergreen coniferous and broad-leaved forests. The reserve has a subtropical maritime monsoon climate, with an average annual temperature of 15.5 °C, extreme maximum temperature of 39.9 °C, extreme minimum temperature of -11.7 °C, and a frost-free period of 225 days. Mean annual precipitation is 1,640 mm, concentrated in June–July.

1.2 Plot Setup and Survey Methods

We selected the main forest vegetation types within the Hynobius amjiensis National Nature Reserve. To ensure adequate sampling across altitude gradients for each vegetation type, we uniformly established plots from low to high altitude, totaling 28 permanent forest monitoring plots of 20 m × 20 m (Table 1). We demarcated plots using laser rangefinders and compasses, with permanent cement markers at the four corners. Each 20 m × 20 m plot was divided into 16 subplots of 5 m × 5 m. Within each subplot, we located, tagged, and recorded all woody plants with diameter at breast height (DBH) $\geq$ 1 cm, including species name, DBH, height, and growth status. Following Guo et al. (2020), we classified the surveyed forest vegetation types based on importance values and life forms: evergreen broad-leaved forest (EBLF), mixed evergreen and deciduous broad-leaved forest (EDBLF), evergreen coniferous forest (ENF), evergreen mixed coniferous and broad-leaved forest (ECBLF), evergreen coniferous and deciduous broad-leaved mixed forest, deciduous broad-leaved forest (BDF), and deciduous coniferous forest (DCF). These vegetation types comprised 1, 5, 6, 2, 1, 12, and 1 plots, respectively (Supplementary Table 1).

1.3 Environmental Factor Measurement

We used handheld GPS to measure the latitude, longitude, and altitude at the center of each plot, and recorded slope position and aspect information.

1.4 Statistical Analysis

We used nonparametric Mann-Whitney tests to analyze differences in species numbers among vegetation types. We counted all woody individuals with DBH $\geq$ 1 cm in each plot to obtain species abundance, ranked species from highest to lowest abundance, and generated species-abundance curves (Whittaker plots) for subsequent SAD model fitting.

To address whether SAD model fittings are consistent across different forest vegetation types, we selected the two most commonly used models—the lognormal model and the logseries model—to fit the species-abundance distribution curves for each plot. The models are expressed as:

Lognormal model:

$$A_i = \log \mu + \log \sigma \quad (i = 1, 2, 3, ...)$$

Logseries model:

$$E_n = \alpha X^n / n \quad (n = 1, 2, 3, ...)$$

$$S/N = [-\ln(1 - X)][(1 - X)/X]$$

$$\alpha = N(1 - X)/X$$

In the lognormal model, and σ represent the mean and variance of the normal distribution, N indicates normal deviation, and A_i denotes the abundance of the i-th species. In the logseries model, E_n represents the abundance of the n-th species, α and X are parameters derived from equations (3) and (4), S is the total number of species, and N is the total number of individuals.

To evaluate model fit, we used the corrected Akaike Information Criterion (AICc) for small samples to select the optimal model. When comparing two models, the one with the lowest AICc value was considered the best fit.

To examine the relationship between SAD shape variation (curve skewness) and altitude, we used parameters from the Gambin and Weibull models that reflect SAD curve shape and species abundance differences. We fitted the Gambin model to each plot’ s SAD using the `fit_{abundances}()` function in the R package “gambin” and calculated the α parameter, which reflects curve shape. The Gambin model combines binomial sampling from a gamma distribution, provides good fit for various data types, and its α parameter effectively reflects curve shape. Generally, larger α values indicate SADs approaching a lognormal distribution, while smaller α values indicate SADs approaching a logseries distribution with greater skewness, higher proportions of rare species (species with relatively low abundance and frequency), and lower proportions of common species (species with relatively high abundance and frequency).

We also used parameters (and λ) from the Weibull model to reflect SAD shape. We fitted the Weibull model using the `fitsad()` function in the “sads” package to calculate and λ values. The parameter represents model curve shape, with ecological meaning similar to α in the Gambin model. Smaller values increase SAD curve skewness; when $= 2$, the distribution approaches lognormal, and when $= 1$, it approaches logseries. The λ parameter represents the scale of species abundance variation, with larger λ values indicating greater differences in species abundance and measuring the range of abundance variation within a community. Currently, these two Weibull parameters serve as universal tools for modeling species abundance distributions and effectively fit SAD shapes across different plant communities.

To ensure accurate model fitting, only plots with more than 10 species were included in the analysis. Ultimately, data from 27 plots met the analytical requirements.

To analyze relationships between SAD shape and altitude, we used linear regression models to examine relationships between altitude and α, , and λ values across all plots. To assess altitude effects on SAD shape within different forest vegetation types, we used linear regression to analyze relationships between SAD model parameters (α, , and λ) and altitude separately for evergreen coniferous forests, mixed evergreen and deciduous broad-leaved forests, and deciduous broad-leaved forests, which each contained at least 6 plots.

All analyses were conducted in R software (R Core Team, 2022).

2.1 Vegetation Types and Species Composition

Our survey of the main forest vegetation in the Hynobius amjiensis National Nature Reserve identified 166 woody species. Among different vegetation types, evergreen broad-leaved forests had the highest species richness, followed by evergreen coniferous forests, mixed evergreen and deciduous broad-leaved forests, and evergreen coniferous and deciduous broad-leaved mixed forests (Figure 1 [Figure 1: see original paper]).

BDF: Broad-leaved deciduous forest; **ENF**: Evergreen coniferous forest; **EDBLF**: Mixed evergreen and deciduous broad-leaved forest; **ECBLF**: Evergreen mixed coniferous and broad-leaved forest; **EBLF**: Evergreen broad-leaved forest; **DCF**: Deciduous coniferous forest. Different lowercase letters among vegetation types indicate significant differences in species number ($P<0.05$).

Figure 1 The number of species in different vegetation types

2.2 Species Abundance Distribution Models Across Vegetation Types

Fitting logseries and lognormal models to species abundance distributions in different plots revealed that the logseries model provided a better fit for almost all plots, with only one plot in evergreen coniferous forest better fitting the lognormal distribution (Table 1).

Table 1 The number of plots in different forest types and the number of SADs fitted to lognormal model or logseries model

Vegetation type	Number of plots	Range of elevation (m)	Lognormal model	Logseries model
Broad-leaved deciduous forest	12	649–1,450	0	12
Evergreen coniferous forest	6	618–1,483	1	5
Mixed evergreen and deciduous broad-leaved forest	5	656–848	0	5

Vegetation type	Number of plots	Range of elevation (m)	Lognormal model	Logseries model
Evergreen mixed coniferous and broad-leaved forest	2	675–717	0	2
Evergreen broad-leaved forest	1	–	0	1
Deciduous coniferous forest	1	–	0	1

2.3 Relationship Between Species Abundance Distribution Models and Altitude

Both the α parameter in the Gambin model and the parameter in the Weibull model reflect SAD curve shape. In this study, α and values were significantly correlated (Figure 2 [Figure 2: see original paper]: $R^2 = 0.372$, $P < 0.001$), indicating consistency between the two models in reflecting SAD shape variation.

When all plots were included, neither the Gambin model' s α value (Figure 3A [Figure 3: see original paper]: $R^2 = 0.005$, $P > 0.05$) nor the Weibull model' s value (Figure 3B: $R^2 = 0.025$, $P > 0.05$) showed significant correlations with altitude. However, the Weibull model' s λ value, which reflects the scale of species abundance distribution, exhibited a significant positive correlation with altitude (Figure 3C: $R^2 = 0.14$, $P = 0.05$).

Figure 2 The linear relationship between Gambin' s α and Weibull' s value

Figure 3 Relationships between altitude and Gambin' s α (A), Weibull' s (B) and Weibull' s λ (C) value

Across different vegetation types, evergreen coniferous forests showed no significant correlation between SAD shape (α and) and altitude. In mixed evergreen and deciduous broad-leaved forests, α values were significantly negatively correlated with altitude, and values also showed a negative relationship with high explanatory power (Table 2). For deciduous broad-leaved forests, λ values were significantly positively correlated with altitude, while α and values showed no significant correlation with altitude (Table 2).

Table 2 Results of linear relationship between Gambin' s α, Weibull' s and λ value and altitude in different vegetation types

Vegetation type	Parameter	Estimated value	Standard error	t-value	R^2 value
Evergreen coniferous forest	α	0.699*	0.559*	–	0.235*
Mixed evergreen and deciduous broad-leaved forest		–	–	–	–
Deciduous broad-leaved forest	λ	–	–	–	–

Note: * $P \leq 0.10$; ** $P \leq 0.01$

3.1 Fitting Lognormal and Logseries Models to Forest Community SADs

Fitting logseries and lognormal models to species abundance distributions (SADs) in the Hynobius amjiensis National Nature Reserve revealed that the logseries model provided a better fit than the lognormal model for SADs across all plots (Table 1). Additionally, all values from the Weibull model were less than 2, further indicating that SADs in the plots better fit the logseries distribution. Ulrich et al. (2016b) found that the lognormal model better fit SADs of global dryland plant communities, suggesting that the lognormal model is associated with environmentally unstable communities characterized by low annual precipitation, high aridity, and high climate variability. Meanwhile, Ulrich et al. (2022) found in grassland studies that the lognormal model was generally applicable under extreme drought conditions, whereas the logseries model suited fertile, well-watered communities with high species richness. Contrasting with dryland plant community studies, numerous tropical and temperate forest studies have also found that the logseries model better fits forest community SADs. Wu et al. (2018) observed that the logseries model adequately fitted SADs across different scales in subtropical secondary forests. Our results similarly demonstrate that the logseries model is more applicable to various vegetation types in this subtropical region. These findings suggest that the logseries model is more suitable for forest vegetation types and reflects the presence of numerous rare species and few common species in the studied forest communities, consistent with previous findings that subtropical forest communities maintain relatively high proportions of rare species.

3.2 Relationship Between Forest Community SAD Shape and Altitude

Although the logseries model provided the best fit for SADs across the study area’ s forest communities, SAD shape may change continuously along environmental gradients due to factors such as climate conditions and habitat heterogeneity. Previous studies have found that altitude, habitat heterogeneity, climate and soil factors, topography and landscape, and disturbance history significantly affect SAD shape. For example, along altitude gradients, forest community SADs may gradually shift from shapes approaching the logseries model toward the lognormal model, i.e., decreasing curve skewness. However, when including all plots, our study found no relationship between SAD shape and altitude gradient, though the λ value reflecting the scale of species abundance variation increased with altitude. This result suggests that as altitude increases, species responses at the abundance level become more pronounced —species adapted to high altitudes show significantly increased relative abundance, while those not adapted show decreased relative abundance. Arellano et al. (2014) found in tropical forests that the proportion of common species along altitude gradients was closely related to species pool size rather than vegetation type. However, our study found that for mixed evergreen and deciduous broad-leaved forests, both α and values decreased with increasing altitude (Table 2), indicating that the proportion of common species decreased while rare species increased at higher altitudes. This may occur because evergreen broad-leaved tree species become maladapted to high-altitude habitats and thus become rare species. Additionally, for the predominantly distributed deciduous broad-leaved forests in the study area, we found that α and λ values increased with altitude (tending toward lognormal distribution), suggesting that species abundance distributions became more uniform at higher altitudes, i.e., the proportion of common species increased (Table 2). This indicates that deciduous broad-leaved forest communities become more stable with increasing altitude.

3.3 Forest Vegetation Conservation and Management

By integrating species richness and abundance information through species abundance distribution models, this study found that forest community SADs in the subtropical Hynobius amjiensis National Nature Reserve primarily conform to logseries model predictions. This suggests that forest communities in this region are dominated by rare species (with relatively low individual abundance), implying that forest conservation and management should not only maintain common or dominant species through tending and thinning but should also prioritize rare species. Furthermore, altitude significantly affects the scale of SAD variation, and its influence on SAD shape differs among vegetation types. Therefore, different conservation and management measures should be implemented for different vegetation types across altitude gradients. For example, in species-rich communities such as mixed evergreen and deciduous broad-leaved forests, α and values decrease with altitude, indicating increased proportions of rare species at higher elevations, thus warranting greater protection for high-altitude mixed forests. For deciduous broad-leaved forests, increasing α and λ values with altitude suggest that low-altitude deciduous broad-leaved forests contain more rare species, requiring focused attention on low-altitude communities. These results demonstrate that using SAD shape variation enables deeper analysis of how multidimensional diversity (richness and abundance) responds to environmental factors compared to considering only species richness or abundance alone, providing more information on community structure and aiding research and decision-making on forest community diversity status, change patterns, and management.

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Supplementary Table

Table S1 Vegetation type information of 28 forest sample plots in Hynobius amjiensis National Nature Reserve

Plot ID	Vegetation type	Vegetation subtype	Community description
LWS15	Evergreen broad-leaved forest	Typical evergreen broad-leaved forest	*Cyclobalanopsis* evergreen broad-leaved forest
LWS10	Mixed evergreen and deciduous broad-leaved forest	Subtropical mountain evergreen and deciduous broad-leaved mixed forest	*Cyclobalanopsis* evergreen and deciduous broad-leaved mixed forest
LWS11	Mixed evergreen and deciduous broad-leaved forest	Subtropical mountain evergreen and deciduous broad-leaved mixed forest	*Cyclobalanopsis* evergreen and deciduous broad-leaved mixed forest

Plot ID	Vegetation type	Vegetation subtype	Community description
LWS24	Mixed evergreen and deciduous broad-leaved forest	Subtropical mountain evergreen and deciduous broad-leaved mixed forest	*Cyclobalanopsis* evergreen and deciduous broad-leaved mixed forest
LWS25	Mixed evergreen and deciduous broad-leaved forest	Subtropical mountain evergreen and deciduous broad-leaved mixed forest	*Cyclobalanopsis* evergreen and deciduous broad-leaved mixed forest
LWS26	Mixed evergreen and deciduous broad-leaved forest	Subtropical mountain evergreen and deciduous broad-leaved mixed forest	*Cyclobalanopsis* evergreen and deciduous broad-leaved mixed forest
LWS06	Evergreen coniferous forest	Warm evergreen coniferous forest	*Cunninghamia lanceolata* warm evergreen coniferous forest
LWS07	Evergreen coniferous forest	Warm evergreen coniferous forest	*Cunninghamia lanceolata* warm evergreen coniferous forest
LWS09	Evergreen coniferous forest	Warm evergreen coniferous forest	*Cunninghamia lanceolata* warm evergreen coniferous forest
LWS04	Evergreen coniferous forest	Temperate evergreen coniferous forest	*Pinus taiwanensis* temperate evergreen coniferous forest
LWS17	Evergreen coniferous forest	Temperate evergreen coniferous forest	*Pinus taiwanensis* temperate evergreen coniferous forest
LWS18	Evergreen coniferous forest	Temperate evergreen coniferous forest	*Pinus taiwanensis* temperate evergreen coniferous forest
LWS13	Evergreen mixed coniferous and broad-leaved forest	Warm evergreen coniferous and broad-leaved mixed forest	*Cunninghamia lanceolata* warm coniferous and broad-leaved mixed forest

Plot ID	Vegetation type	Vegetation subtype	Community description
LWS12	Evergreen mixed coniferous and broad-leaved forest	Warm evergreen coniferous and broad-leaved mixed forest	*Cunninghamia lanceolata* warm coniferous and broad-leaved mixed forest
LWS08	Evergreen coniferous and deciduous broad-leaved mixed forest	Warm evergreen coniferous and deciduous broad-leaved mixed forest	*Cryptomeria fortunei* and *Sassafras tzumu* warm coniferous and broad-leaved mixed forest
LWS16	Deciduous broad-leaved forest	Warm deciduous broad-leaved forest	*Quercus* deciduous broad-leaved forest
LWS05	Deciduous broad-leaved forest	Warm deciduous broad-leaved forest	*Cyclocarya paliurus* deciduous broad-leaved forest
LWS14	Deciduous broad-leaved forest	Warm deciduous broad-leaved forest	*Albizia kalkora* deciduous broad-leaved forest
LWS27	Deciduous broad-leaved forest	Warm deciduous broad-leaved forest	*Parrotia subaequalis* deciduous broad-leaved forest
LWS22	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Sorbus* deciduous broad-leaved forest
LWS20	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Sorbus* deciduous broad-leaved forest
LWS21	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Sassafras tzumu* and *Ailanthus altissima* deciduous broad-leaved forest
LWS28	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Ailanthus altissima* and *Cornus kousa* deciduous broad-leaved forest
LWS02	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Pyrus* deciduous broad-leaved forest
LWS03	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Quercus* deciduous broad-leaved forest
LWS19	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Quercus* deciduous broad-leaved forest

Plot ID	Vegetation type	Vegetation subtype	Community description
LWS01	Deciduous broad-leaved forest	Temperate deciduous broad-leaved forest	*Quercus aliena* var. *acuteserrata* deciduous broad-leaved forest
LWS23	Deciduous coniferous forest	Warm deciduous coniferous forest	*Pseudolarix amabilis* warm deciduous coniferous forest

Note: Figure translations are in progress. See original paper for figures.

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