Study on the Stand Spatial Structure and Species Diversity of different forest types

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Contents

❖ Studies on spatial distribution of communities even species diversity are great importance for sustainable management.

- Whether there is a kind of relationship between them?
- And What it is?

Background

❖ The evergreen, deciduous and broadleaved forests in Shitai County are the zonal vegetation in the northern rim of subtropical region.

❖ However, owing to man-caused destructions and other reasons, the primeval zonal vegetation has disappeared; hence, what exist now are mostly natural secondary forests and man-made forests.

Background

Figure1 Vertical distributions above the vegetation

Over 500m

Below 500m

coppice

deciduous and broadleaved forests

evergreen and deciduous broadleaved forests

evergreen broadleaved forests
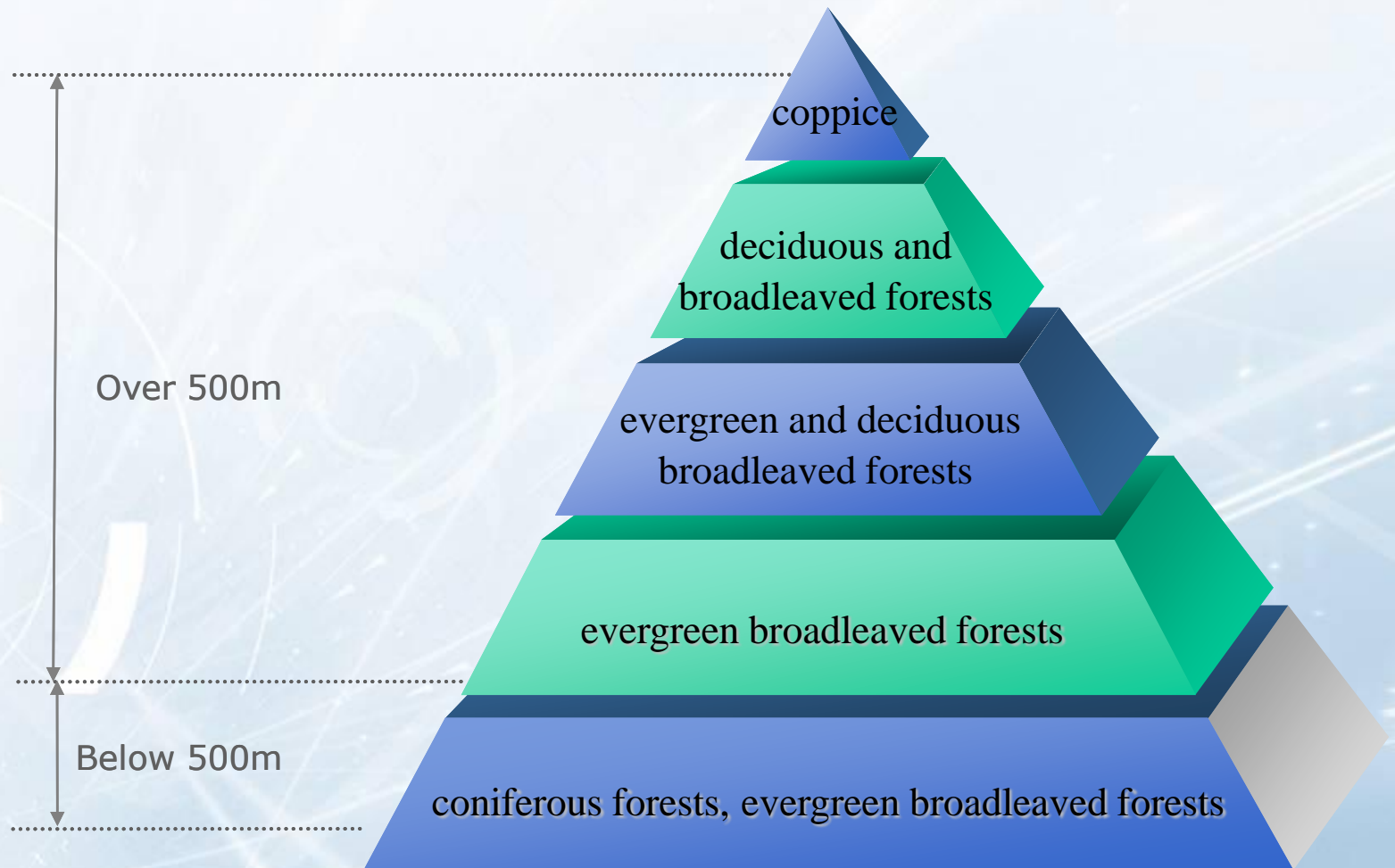
coniferous forests, evergreen broadleaved forests

❖ **Plots selection and inventories**

■ A dense base grid of 100 by 100m is basis for the selection of sampling locations inside SFM forest stands.

■ Selected five fixed sample in each inventory stand randomly, and set a temporary sample which 25 m away from the fixed sample and on its north direction.

■ Measuring and recording the tree height, DBH, horizontal distance and other trees factor according to r<6m,10cm<d<20cm;
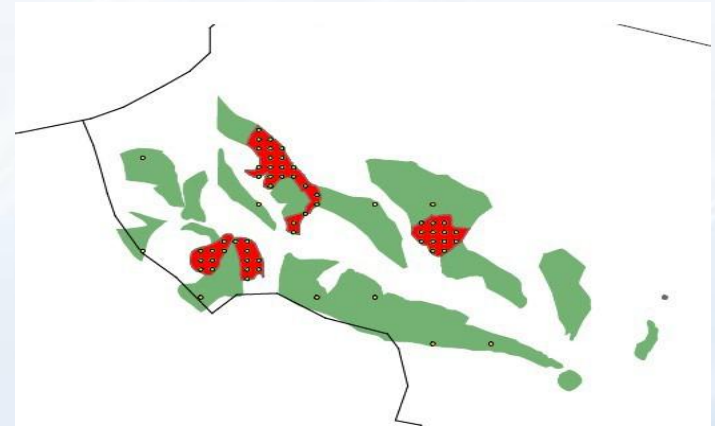6m<r<10m,d>20cm in the sample plot.
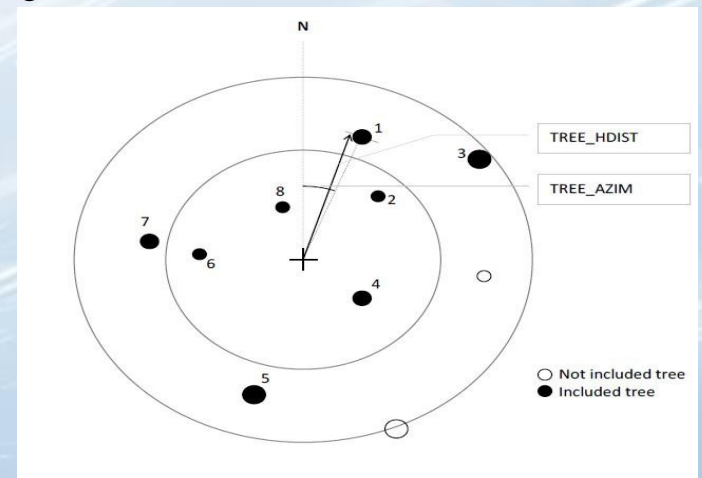
Figure2 From Lin4carbon forest inventory guidelines

Figure3 From Lin4carbon forest inventory guidelines

Research methods

Table 1 Stand overview

Forest types	Main species	Age	Average DBH	Average height
natural evergreen broadleaved forests	*Castanopsis sclerophylla (Lindl.) Schott.* *Cyclobalanopsis glauca(Thunb.) Oerst.*	mature forest	15.2	12.2
natural evergreen and deciduous broadleaved forests	*Quercus acutissima Carruth.* *Liquidamba formosana Hance*	mature forest	21.2	12.4
natural coniferous and broadleaved forests	*Cunninghamia lanceolata(Lamb.)Hook.* *Castanopsis sclerophylla (Lindl.) Schott.*	mature forest	18.7	11.2
man-made coniferous and broadleaved forests	*Cunninghamia lanceolata(Lamb.)Hook.* *Liquidamba formosana Hance*	mature forest	14.3	9.9

❖ **Point pattern analysis**

- *O-ring* univariate statistics

❖ **Analysis of species diversity**

- Community evenness index (Pielou Index): D=H/ln$S$.

- Species diversity index (Shannon-wiener Index): $H=-\sum P_i \ln P_i$.

- Ecological dominance index (Simpson Index): J=$\sum (n_i-1) n_i/N(N-1)$.

- Important value=(relative abundance+ relative frequency+ relative salience) /3

- In the equation, S represents sum, Pi shows the proportion of individual object (ni) to total individuals (N), that is, Pi=ni/N, i=1,2,3,…,S.
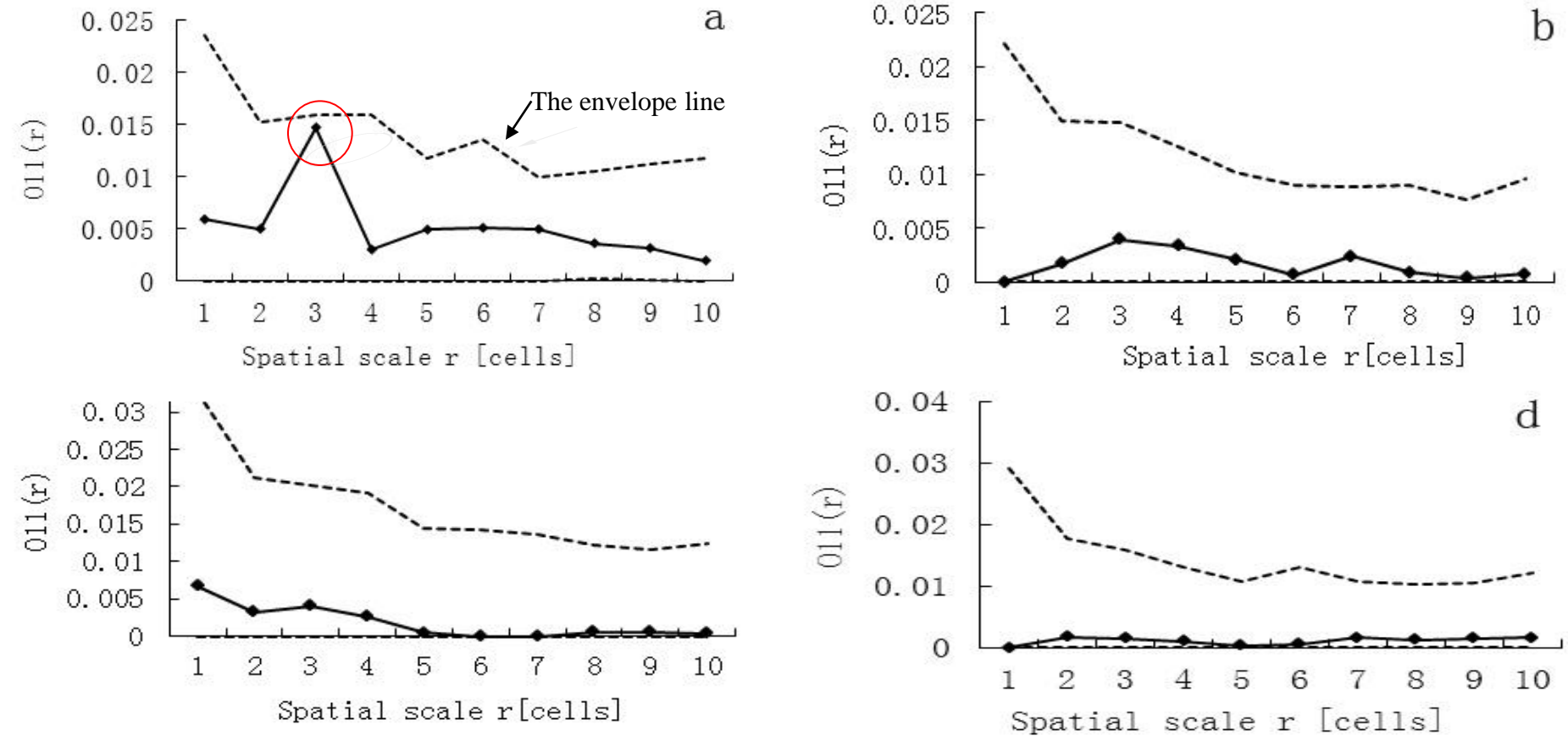
❖ **Spatial structure of different forest types**

- Natural evergreen broad-leaved forest:

  on a scale of 1 ~ 2m and 4~10m   a random distribution

  in the 3m scale   a slight accumulation distribution

- Natural evergreen and deciduous broad-leaved mixed forest

  in the 2 ~ 5m and 7m scale distributed randomly

  in the 1m, 6m and 8-10m scale showed a slight uniform distribution.

- Natural conifer performance

  on a scale of 1 ~ 4m randomly distributed

  on 5 ~ 10m scale showed a slight uniform distribution.

- Artificial coniferous

  on 0 ~ 10m scale illustrated a uniform distribution of light

a natural evergreen broadleaved forests **b** natural evergreen and deciduous broadleaved forests
c natural coniferous and broadleaved forests **d** mam-made coniferous and broadleaved forests

Figure4 Spatial structure of different forest types

❖ Analysis of Important Values

Tree species	Important values			
	Type1	Type2	Type3	Type4
Cunninghamia lanceolata	11.15	15.13	**21.22**	**49.36**
Castanopsis sclerophylla	**28.49**	2.22	11.54	11.25
Liquidamba formosana Hance	7.01	10.96	7.85	17.76
Quercus acutissima Carruth.	-	**29.86**	**19.88**	-
Castanea mollissima Blume	2.43	-	-	6.16
Castanopsis. eyrei Tutch.	8.51	8.11	14.85	6.56
Pinus massoniana Lamb	-	-	5.29	5.36
Cyclobalanopsis glauca	21.04	10.09	5.1	0.96
Toxicodendron succedaneum	-	4.93	4.37	0.91
Cupressus funebris Endl.	-	-	3.76	-
Sophora japonica	-	-	1.96	-
Diospyros Iotus Linn	-	9.94	1.45	-
Pistacia Chinensis	-	6.46	1.42	-
Cinnamomum camphora	-	2.34	1.31	-
Castanea henryi	9.37	-	-	-
Loropetalum chinense	11.99	-	-	-
Sassafras tsumu	-	-	-	1.68

*Type1\2\3\4 stands for natural evergreen broadleaved forests, natural evergreen and deciduous broadleaved forests, natural coniferous and broadleaved forests **and** mam-made coniferous and broadleaved forests

Table2 Important Values of different trees in different forests

Analysis of Species Diversity Index

- Diversity and ecological dominance index

  Evergreen broad-leaved forest, the community is relatively stable, the largest index of species diversity; evergreen and deciduous forest close to the top of the succession, species diversity index higher, more stable communities. Conifer is a transitional type of coniferous and broad-leaved forest was unstable, low species diversity index. The diversity of natural conifer than artificial conifer large, indicating anthropogenic interference slows the natural succession of the community.

- Evenness index

  a natural evergreen and deciduous broad-leaved forest> natural conifer> natural evergreen broadleaf forest> artificial conifer, because the artificial conifer, the advantages of fir clearly, therefore lower community evenness. Uniformity when considering the relationship between diversity and community stability, uniformity index, the higher the higher the stability of the community, from the perspective of succession dynamic stability is higher. From the analysis results in Table 3, the natural evergreen broad-leaved forest, natural evergreen broadleaf deciduous forest, and natural conifer community stability are high, and the Survey Shitai County match.

Table3 Diversity indexes of different forest types

Forest types	SIMPSON(J)	SHANNON-WINNER(H)	PIELIOU
Type1	0.6372	1.6148	0.8537
Type2	0.6219	1.4181	0.8720
Type3	0.6145	1.3266	0.8569
Type4	0.5068	1.1162	0.8000

*Type1\2\3\4 stands for natural evergreen broadleaved forests, natural evergreen and deciduous broadleaved forests, natural coniferous and broadleaved forests **and** man-made coniferous and broadleaved forests

❖ **Relations between Spatial Structure and species Diversity**

From a statistical point of view, the findings point pattern of trees and species diversity, diversity stand spatial structure and species distribution of randomness has certain inherent relationships. Stand in a random spatial pattern often means growing community; the development is affected by many factors, which also contains a rich diversity of species. Therefore, the random spatial distribution pattern is conducive to the protection of species diversity.

Discussion

❖ Choosing the species of adjustment based on the natural regeneration and structure characteristics of forest stand, protect the randomness of tree structure, keep the fine individual advantage tree species and rare species, to adjust the number of main associated tree species, when optimizing the existing forest stand structure in Shitai County.

❖ Environmental factors as altitude, illumination, temperature and terrain factors like slope ang aspect also affecting the production of biological diversity, and altitude is one of the important factors that affect the vegetation distribution and structure, more study is needed to analysis the relationship between the environmental factors and species diversity.

Acknowledgements

Thank You !