



Research Article

DYNAMICS OF 18 (*Sophora japonica*) TREE COMMUNITY'S TOTAL TRUNK VOLUME ALONG ELEVATION GRADIENT IN *Ye County*

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ABSTRACT

Applying communities diversity techniques and SPSS statistic analysis, this study quantify how that correlation between trunk volume of 18 (*Sophora japonica*) communities and elevation along elevation. We concluded that there is a significantly positive correlation between trunk volume of 18 (*Sophora japonica*) tree communities and elevation ($P < 0.01$). Elevation is a key factor driver trunk volume of (*Sophora japonica*) communities increased along elevation from 50m to 200m. Therefore, understanding dynamic connection between trunk volume of 18 (*Sophora japonica*) tree communities and elevation can be not just applied to preserve of 18 (*Sophora japonica*) communities, but also applied to sustainable of tree diversity and ecological processes of trunk volume of different tree community along elevation at spiral-temporal-environmental scales in the future of *Ye County* in 2018.

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INTRODUCTION

The correlation between community's structure and elevation gradient include woody community structure and functioning¹, phylogenetic woody community's structure and function^{2,3}, structure and diversity of invasive community⁴, dynamics of woody community composition and structure^{5,6}, tree community structure differences⁷, woody functional traits and structure⁸, tree community's height⁹ in the environmental dynamics along elevation gradient at spatial-temporal-environmental scales in the different ecosystems. However, there are the correlation between trunk volume of (*Sophora japonica*) communities and elevation gradient in *Ye County* in 2018.

Unfortunately, the concept of different tree community's structure is used as a framework for investigating the linkages between (*Sophora japonica*) communities and elevation habitats in *Ye County*⁹. Moreover, more and more experiments or models have assessed the relationship between plant communities and elevation along elevation or environment or disturbance gradient⁷⁻¹³. For instance, Liao, et al. (2019) found that (*Sophora japonica*) tree community's height were significantly correlated with elevation⁹. Liao, et al. (2011a; 2014) found that the importance values of tree species's structure were significantly correlated with elevation along elevation on the northern and southern slope of the *Fu-Niu Mountain*^{10,11}. Liao, et al.

(2011b) proposed that plant species biomass were significantly correlated with elevation in the wetland area of *Yi-Luo River watershed*¹². Liao, et al. (2014b) suggested that biodiversity were significantly negatively correlated with disturbance¹³. Meanwhile, *Sophora japonica* is an important international pharmaceutical materials in *Ye County* in 2018⁹.

Therefore, the objective of this research was to define the correlation between trunk volume of (*Sophora japonica*) tree communities and elevation gradient at spatial-temporal-environmental scales in the forest ecosystem of *Ye County* in 2018.

The Physical Geographic Conditions And Study Methods

Ye County is an important county in *Ping-ding-shan Region*. The urbanization of ecosystem is results of the historical natural and anthropogenic activities in *Ye County*. It is regional urbanization mostly in the height of more than 600 m (Figures 1-4; Table 1-2). Three fields of plant diversity of investigations were conducted in 2018, investigating the plant communities diversity in *Ye County* (Figures 1-4; Table 1-2). A field investigation was conducted in 2018, to study the dynamics of trunk volume of (*Sophora japonica*) tree communities and elevation along elevation in *Ye County*. The (*Sophora japonica*) tree community's ecosystem of *Ye County* is the dominated by natural ecosystem with tree communities from 50 m to 650 m. Possessing steep environmental gradients along elevation gradient, this area is idea for studying (*Sophora japonica*) tree communities and species (Figures 1-4; Table 1-2).

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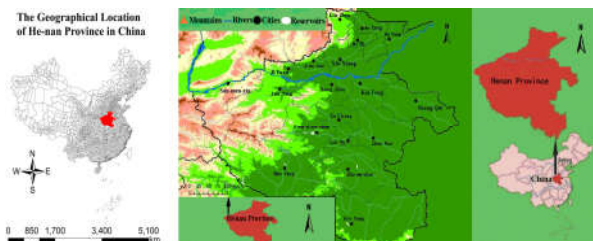


Fig 1 A Digital Cadastre Map of Location of He-nan Province in China

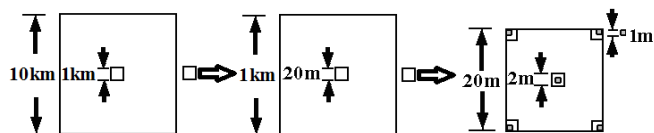


Fig 2 Quadrate settings

Table 1 The natural-physical geographic conditions and vegetation in Ye County

Location and Elevation	Climatic/Area	Vegetation (Plant Functional Groups)
Latitude(°): 33.42-33.68	Precipitation (mm):724	Trees:Ulmaceae/Cupressaceae/Moraceae/Moraceae /Platanaceae, <i>Sophora japonica</i> , et al.
Longitude(°): 113.27-113.46	Temperature(°C) (Mean) :15.2	Shrubs:Rhamnaceae/Verbenaceae/Buxaceae/Oleaceae /Rosaceae/Vitaceae/Bignoniaceae/Cornaceae, et al.
Elevation(m) †: 50-650	Sunlight: 2230h Area(km ²):1387	Herbs:Compositae/Leguminosae/Urticaceae/Gramineae/ Convolvulaceae/Cyperaceae/Liliaceae/Umbelliferae, et al.

†Above sea level.

Applying plant community ecology techniques, GIS of techniques, a number of landscape maps, SPSS statistic analysis, we investigated all plant species (dominant and companion communities) on the southern, southeastern, western, eastern, northern, southwestern, northeastern, and northwestern at spiral-temporal-environmental scales along elevation gradient in Ye County in 2018 (Figures 1-4; Table 1-2).

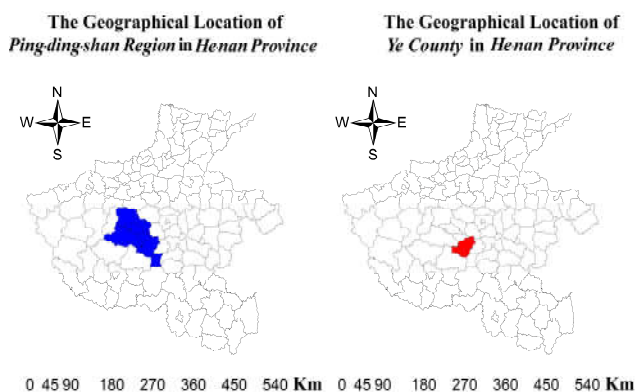


Fig 3 The Geographical Location of Ping-ding-shan Region in He-nan Province

and the Geographical Location of Ye County in He-nan Province
Note: ■ Ping-ding-shan Region ■ Ye County

Dynamics of Landscape Elements in Ye County in 2018

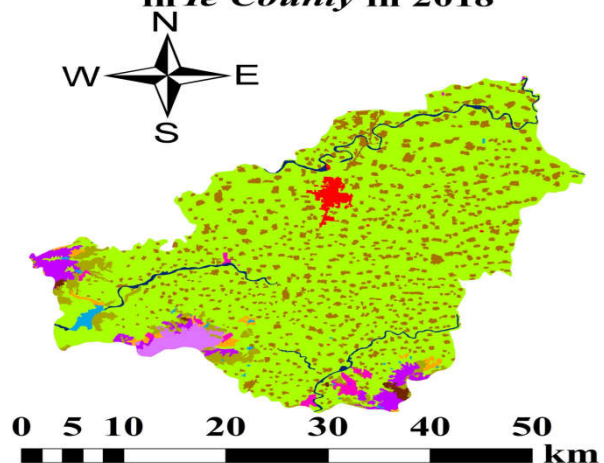


Fig 4 Dynamics of different landscape areas and landscape perimeters and landscape patch numbers in Ye County in 2018

Note: ■ Urbanization of Land Use ■ Farmlands of Land Use ■ Rural Settlements of Land Use
■ Reservoirs ■ Rivers and Wetland ■ Plantation of Land Use ■ Natural Forest of Land Use
■ Grassland of Coverage Ratio during 20%-50% ■ Grassland of Coverage Ratio >50%

There are 8 study plots establishing in per 10 m elevation by different azimuth and direction (East, West, South, Southeast, Southwest, North, Northeast, and Northwest) in 2018. A total of 60 plots were set in three times investigating. Each study plot (Figures 1-4), consisted of one 20 × 20 m tree layer quadrat, five (the center and four corners of the study plot) 2 × 2 m shrub layer quadrates and 1 × 1 m herb layer quadrates. Thus, there were 180 tree layer, 900 shrub layer, and 900 herbaceous layer quadrates (Fig.1-3; Tab.2-4). Moreover, different plant species identified during this investigation were assigned into three communities according to plant life form: 1) tree communities; 2) shrub communities; 3) herb communities¹⁰⁻¹³.

RESULTS

The study showed three rules of the correlation between (*Sophora japonica*) tree communities and elevation along different elevation gradients (Figure5; Table 3).

Firstly, these shows there are trunk volume of 18 (*Sophora japonica*) tree communities along differential elevation between 50 and 200 m in Ye County.

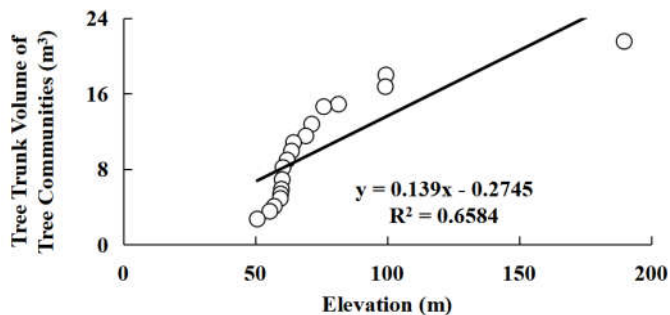
Secondly, this study show that trunk volume of 18 (*Sophora japonica*) tree communities increased along elevation gradients. Meanwhile, the study analyzed the relationship between trunk volume of 18 (*Sophora japonica*) communities and elevation in Ye County. Regression equation is “y=0.139x-0.2745, (R²=0.6584)”.

Thirdly, there is a significantly positive correlation between trunk volume of 18 (*Sophora japonica*) tree communities and elevation (P<0.01) in Ye County in 2018.

Thus, the research explained that elevation is the dominant natural environment driver of trunk volume of 18 (*Sophora japonica*) tree communities increased along elevation gradient from 50 m to 200 m in Ye County.

Table 2 Investigation index along the elevation and disturbance gradient variable

Investigation	Disturbance Types /Intensity/Frequency	Layer	Community	Species	Height	Crow	Diameter
Different plant community investigation	Differential Artificial disturbance /Natural disturbance	Trees /shrubs /herbs	Coverage/ community's age structure	Species/ individual number	Different Layer's Height	Crow Height /width	Different basal diameter

**Fig 5** Dynamics of trunk volume of 18 tree communities along elevation gradient.**Table 3** Correlating to trunk volume of tree communities and elevation gradient

Trunk Volume of Tree Communities	Correlation between trunk volume of 18 (<i>Sophora japonica</i>) tree communities and elevation gradient
Total Trunk Volume of (<i>Sophora japonica</i>) Tree Communities	0.811**

Note: *, $P < 0.05$; **, $P < 0.01$.

DISCUSSION

This study showed that three vital areas will substantially further effects to gain a rigorous understanding of three rules

1. There are trunk volume of 18 (*Sophora japonica*) tree communities along elevation gradient between 50 and 200 m of *Ye County* in 2018. Meanwhile, the trunk volume of 18 dominant (*Sophora japonica*) tree community increased along elevation gradient. Regression equation is “ $y = 0.139x - 0.2745$, ($R^2 = 0.6584$)”.
2. This study showed that there is a significantly positive correlation between trunk volume of 18 (*Sophora japonica*) tree communities and elevation gradient ($P < 0.01$).
3. This study showed that elevation was the dominant environment driver of trunk volume of 18 (*Sophora japonica*) communities increased along elevation gradient.

Thus, the results indicate that elevation was the dominant environment driver of trunk volume of 18 (*Sophora japonica*) tree communities increased along elevation gradient. This study supported the experiments or models that elevation gradient is an important environmental factor affecting dynamics of tree communities distribution¹⁴, tree community variation¹⁵, composition and biomass of tree community¹⁶, dynamics of tree communities (structure and composition and diversity of tree community)¹⁷⁻¹⁹, structure and economics of tree leaf^{20,21}, structure and taxa regeneration of tree²², structure growth and physiological responses of tree²³, woody structure growth rates²⁴,

dynamics of community's density and carbon and diversity^{25,26} along environment gradient in the natural ecosystems along elevation gradient in *Ye County* in the future.

CONCLUSION

In this paper, the study explained that there is a significantly positive correlation between trunk volume of 18 (*Sophora japonica*) tree communities and elevation gradient ($P < 0.01$). This study explained that elevation is the key environmental factor driver of trunk volume of 18 (*Sophora japonica*) tree communities of international pharmaceutical materials increased along elevation gradient from 50 m to 200 m in *Ye County* in 2018. Therefore, understanding dynamic connecting trunk volume of 18 (*Sophora japonica*) tree communities and elevation can be not just applied to preserve of (*Sophora japonica*) tree communities, but also applied to sustainable of biodiversity and processes trunk volume of (*Sophora japonica*) tree communities along elevation at spatial-temporal-environmental scales in *Ye County* in the future.

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