**Tables:**

Table 1 Habitat factors of four plots

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P1 | P2 | P3 | P4 |
| Area/m2 | 7000 | 19500 | 7400 | 7200 |
| Altitude/m | 1980 | 1780 | 1760 | 1890 |
| Slope/° | 40 | 20 | 30 | 24 |
| Aspect | Northwest | Northwest | Northwest | Northwest |
| Litter depth /cm | 2.6 | 1.68 | 1.42 | 1.16 |
| Humidity/% | 89.08 | 82.36 | 77.74 | 93.61 |
| Vegetation type | EDMF | EDMF | EDMF | EDMF |

EDMF：evergreen and deciduous broad-leaved mixed forest

Table 2 Population structure of *T. sinense* in four plots

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Plot | DBH/cm | Age-class | Individuals | Plot | DBH/cm | Age-class | Individuals |
| P1 | 0-1 | Ⅰ | 0 | P3 | 0-1 | Ⅰ | 0 |
|  | 1-2.5 | Ⅱ | 3 |  | 1-2.5 | Ⅱ | 3 |
|  | 2.5-7.5 | Ⅲ | 18 |  | 2.5-7.5 | Ⅲ | 12 |
|  | 7.5-12.5 | Ⅳ | 9 |  | 7.5-12.5 | Ⅳ | 12 |
|  | 12.5-17.5 | Ⅴ | 0 |  | 12.5-17.5 | Ⅴ | 1 |
|  | 17.5-22.5 | Ⅵ | 1 |  | 17.5-22.5 | Ⅵ | 3 |
|  | 22.5-27.5 | Ⅶ | 0 |  | 22.5-27.5 | Ⅶ | 0 |
|  | 27.5-32.5 | Ⅷ | 0 |  | 27.5-32.5 | Ⅷ | 1 |
|  | 32.5-37.5 | Ⅸ | 0 |  | 32.5-37.5 | Ⅸ | 1 |
|  | 37.5-65 | Ⅹ | 2 |  | 37.5-65 | Ⅹ | 1 |
| P2 | 0-1 | Ⅰ | 1 | P4 | 0-1 | Ⅰ | 0 |
|  | 1-2.5 | Ⅱ | 11 |  | 1-2.5 | Ⅱ | 7 |
|  | 2.5-7.5 | Ⅲ | 14 |  | 2.5-7.5 | Ⅲ | 18 |
|  | 7.5-12.5 | Ⅳ | 18 |  | 7.5-12.5 | Ⅳ | 7 |
|  | 12.5-17.5 | Ⅴ | 2 |  | 12.5-17.5 | Ⅴ | 1 |
|  | 17.5-22.5 | Ⅵ | 0 |  | 17.5-22.5 | Ⅵ | 1 |
|  | 22.5-27.5 | Ⅶ | 2 |  | 22.5-27.5 | Ⅶ | 0 |
|  | 27.5-32.5 | Ⅷ | 2 |  | 27.5-32.5 | Ⅷ | 1 |
|  | 32.5-37.5 | Ⅸ | 0 |  | 32.5-37.5 | Ⅸ | 0 |
|  | 37.5-65 | Ⅹ | 1 |  | 37.5-65 | Ⅹ | 2 |

Table 3 Characteristics of tree species in the arbor layer

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Plot | Species | Numbers | DBH/cm | Basal area/cm² | RD | RF | RP | W |
| P1 | *Styrax japonicus* | 20 | 10.10 | 80.08 | 0.41 | 0.80 | 0.10 | 130.58 |
| *Pterostyrax psilophyllus* | 4 | 12.00 | 113.04 | 0.08 | 0.80 | 0.14 | 101.53 |
| *Prunus tomentosa* | 9 | 6.17 | 29.88 | 0.18 | 0.60 | 0.04 | 81.58 |
| *Tetracentron sinense* | 5 | 9 | 63.59 | 0.10 | 0.60 | 0.08 | 77.61 |
| *Acer sinense* | 4 | 9 | 63.59 | 0.08 | 0.60 | 0.08 | 75.61 |
| *Cladrastis wilsonii* Takeda | 1 | 18 | 254.34 | 0.02 | 0.20 | 0.30 | 52.44 |
| *Symplocos* *sumuntia* Buch. -Ham. ex D. Don | 2 | 16 | 200.96 | 0.04 | 0.20 | 0.24 | 48.05 |
| *Litsea* *pungens* Hemsl. | 4 | 6.2 | 30.18 | 0.08 | 0.20 | 0.04 | 31.61 |
| P2 | *Pterostyrax* *psilophyllus* | 5 | 19.40 | 295.440 | 0.25 | 0.60 | 0.21 | 106.30 |
| *Styrax* *japonicus* | 4 | 27.00 | 572.27 | 0.20 | 0.40 | 0.41 | 101.26 |
| *Prunus* *tomentosa* | 4 | 10.00 | 78.50 | 0.20 | 0.20 | 0.57 | 96.60 |
| *Tetracentron sinense* | 3 | 14.33 | 161.20 | 0.15 | 0.60 | 0.12 | 86.62 |
| *Acer* *sinense* | 3 | 10.00 | 78.50 | 0.15 | 0.60 | 0.06 | 80.66 |
| *Juglans* *mandshurica* Maxim. | 1 | 16.00 | 200.96 | 0.05 | 0.20 | 0.14 | 39.49 |
| P3 | *Pterostyrax* *psilophyllus* | 7 | 10.43 | 85.40 | 0.35 | 0.60 | 0.10 | 104.53 |
| *Prunus* *tomentosa* | 3 | 6.50 | 33.17 | 0.15 | 0.60 | 0.05 | 79.92 |
| *Styrax* *japonicus* | 2 | 9.00 | 63.59 | 0.10 | 0.40 | 0.09 | 59.43 |
| *Acer* *sinense* | 2 | 12.00 | 78.50 | 0.10 | 0.40 | 0.09 | 58.76 |
| *Tetracentron* *sinense* | 2 | 8.20 | 52.78 | 0.10 | 0.40 | 0.08 | 57.83 |
| *Quercus* *fabri* Hance | 1 | 17.00 | 226.87 | 0.02 | 0.20 | 0.34 | 55.66 |
| *Acer* *davidii* Franch. | 1 | 8.00 | 50.24 | 0.05 | 0.20 | 0.07 | 32.45 |
| *Schima* *superba* Gardner & Champ. | 1 | 6.00 | 28.26 | 0.05 | 0.20 | 0.04 | 29.19 |
| *Toxicodendron* *succedaneum* (L.) Kuntze | 1 | 6.00 | 28.26 | 0.05 | 0.20 | 0.04 | 29.19 |
| P4 | *Acer* *sinense* | 5 | 9.50 | 70.85 | 0.26 | 0.80 | 0.08 | 113.71 |
| *Styrax* *japonicus* | 4 | 11.50 | 103.82 | 0.21 | 0.60 | 0.11 | 92.30 |
| *Pterostyrax* *psilophyllus* | 3 | 12.00 | 113.04 | 0.16 | 0.40 | 0.12 | 68.30 |
| *Prunus* *tomentosa* | 2 | 10.00 | 78.50 | 0.11 | 0.40 | 0.09 | 59.54 |
| *Tetracentron* *sinense* | 2 | 6.90 | 37.37 | 0.11 | 0.40 | 0.04 | 55.07 |
| *Cladrastis* *wilsonii* | 1 | 18.60 | 271.58 | 0.05 | 0.20 | 0.30 | 54.56 |
| *Sassafras* *tzumu* (Hemsl.) Hemsl. | 1 | 14.50 | 165.05 | 0.05 | 0.20 | 0.18 | 42.97 |
| *Acer* *davidii* | 1 | 10 | 78.50 | 0.05 | 0.20 | 0.09 | 33.54 |

Table 4 Interpolation accuracy analysis of mineral elements in each plot

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Plot | Mineral element | ME | RMSE | MSE | RMSSE |
| P1 | Na | -1.02300 | 1.17200 | -0.03100 | 0.94721 |
|  | Ca | -0.00461 | 0.12595 | -0.02178 | 0.98890 |
|  | Mg | 0.00209 | 0.23505 | 0.01075 | 1.02636 |
|  | Zn | -0.14927 | 0.61326 | -0.01808 | 0.94247 |
|  | N | 0.01666 | 1.12700 | 0.01845 | 1.07030 |
|  | P | 0.00313 | 0.12706 | 0.02260 | 0.96040 |
|  | K | 0.06485 | 1.09660 | 0.01238 | 1.03720 |
| P2 | Na | 0.58332 | 1.38997 | 0.01932 | 0.97465 |
|  | Ca | -0.00002 | 0.19043 | -0.00011 | 1.07118 |
|  | Mg | 0.00283 | 0.24652 | 0.00981 | 0.94075 |
|  | Zn | -0.03787 | 1.31152 | -0.00266 | 1.07521 |
|  | N | 0.00023 | 1.56816 | 0.00908 | 0.86748 |
|  | P | 0.00072 | 0.20394 | 0.00192 | 0.96787 |
|  | K | -0.00658 | 1.62860 | -0.00125 | 1.08733 |
| P3 | Na | 0.18232 | 1.46660 | 0.01287 | 1.00738 |
|  | Ca | 0.00951 | 0.61053 | 0.01641 | 0.97368 |
|  | Mg | 0.00426 | 0.56882 | 0.00969 | 1.13322 |
|  | Zn | -0.19015 | 1.17931 | -0.02397 | 0.98194 |
|  | N | -0.14440 | 1.70290 | -0.10812 | 1.28113 |
|  | P | -0.00178 | 0.15119 | -0.01043 | 1.12306 |
|  | K | -0.51625 | 1.19714 | -0.11022 | 1.29380 |
| P4 | Na | 0.42049 | 1.17608 | 0.01632 | 0.95748 |
|  | Ca | -0.00273 | 0.13932 | -0.00604 | 0.96224 |
|  | Mg | 0.00228 | 0.41482 | 0.00181 | 0.91317 |
|  | Zn | -0.04380 | 1.06728 | -0.00757 | 1.07649 |
|  | N | 0.01510 | 1.46780 | 0.00980 | 1.06428 |
|  | P | -0.00254 | 0.21985 | -0.00824 | 0.99890 |
|  | K | -0.00971 | 1.41544 | -0.00153 | 1.03424 |

Note, mean error (ME), root mean square error (RMSE), standard mean error (MSE), standard root mean square error (RMSSE). N (g/kg), P (g/kg), K (g/kg), Zn (mg/kg); Mg (g/kg); Na (mg/kg); Ca (g/kg).

Table 5 Correlations between environmental factors and the ordination axis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Plot** | **Statistic** | **Axis 1** | **Axis 2** | **Axis 3** | **Axis 4** | **%Explained** | **Pseudo F** | **P** |
| **P1** | humidity | -0.6648 | -0.4469 | -0.151 | 0 | 34.5 | 5.3 | 0.018 |
|  | altitude | 0.5237 | -0.3409 | -0.09 | 0 | 30.8 | 4.5 | 0.014 |
|  | K | -0.5415 | -0.3914 | 0.0993 | 0 | 21 | 2.7 | 0.06 |
|  | Zn | -0.4118 | 0.5031 | 0.0802 | 0 | 18.8 | 2.3 | 0.094 |
|  | shade density | -0.445 | 0.2649 | -0.0067 | 0 | 17 | 2.1 | 0.096 |
|  | litter depth | -0.771 | 0.2139 | 0.0695 | 0 | 13.1 | 1.5 | 0.206 |
| **P2** | humidity | 0.0892 | 0.5368 | 0.2936 | -0.1854 | 22.6 | 2 | 0.144 |
|  | litter depth | 0.3354 | 0.3937 | -0.1211 | -0.3518 | 11.1 | 1 | 0.318 |
|  | P | 0.1993 | 0.4414 | 0.4015 | 0.1916 | 9.3 | 0.8 | 0.41 |
|  | altitude | -0.1887 | -0.3835 | -0.4966 | -0.36 | 13.1 | 1.2 | 0.342 |
|  | Ca | 0.2879 | 0.4766 | 0.1041 | -0.1164 | 5.2 | 0.4 | 0.648 |
|  | K | -0.2383 | 0.6875 | -0.0364 | 0.1869 | 3.1 | 0.2 | 0.826 |
| **P3** | Ca | -0.4998 | 0.5363 | -0.5156 | 0.0712 | 32.4 | 3.3 | 0.006 |
|  | shade density | 0.7323 | -0.3866 | -0.4592 | -0.0319 | 23.9 | 3.3 | 0.038 |
|  | altitude | 0.4251 | -0.168 | -0.7188 | -0.0007 | 22.7 | 5.4 | 0.016 |
|  | K | -0.775 | -0.0587 | 0.3506 | 0.0627 | 3.4 | 0.8 | 0.526 |
|  | P | -0.1521 | 0.131 | -0.7444 | 0.0068 | 3.3 | 0.7 | 0.588 |
|  | Zn | -0.5148 | -0.6245 | 0.2877 | -0.1371 | 8.1 | 2.6 | 0.12 |
| **P4** | humidity | 0.5986 | 0.4235 | -0.1647 | 0.0046 | 27 | 3 | 0.044 |
|  | altitude | 0.5316 | -0.087 | -0.0165 | -0.1689 | 15.2 | 1.8 | 0.168 |
|  | K | 0.5524 | 0.2627 | -0.2933 | -0.1194 | 5.2 | 0.6 | 0.68 |
|  | N | -0.6236 | -0.3937 | -0.0818 | -0.0527 | 3.1 | 0.3 | 0.848 |
|  | P | 0.3963 | -0.6432 | -0.1329 | 0.0842 | 6.3 | 0.6 | 0.676 |
|  | litter depth | 0.6877 | -0.2725 | -0.1618 | 0.0206 | 1.6 | 0.1 | 0.942 |

Note, K (potassium), Zn (zinc), P (phosphorus), Ca (calcium) and N (nitrogen).

Table 6 CCA ordination summary of plots

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Plot** | **Statistic** | **Axis 1** | **Axis 2** | **Axis 3** | **Axis 4** |
| **P1** | Eigenvalues | 0.2775 | 0.1364 | 0.0361 | 0.1348 |
|  | Explained variation (cumulative) | 43.33 | 64.62 | 70.26 | 91.3 |
|  | Pseudocanonical correlation | 0.8826 | 0.8474 | 0.6187 | 0 |
| **P2** | Eigenvalues | 0.0891 | 0.078 | 0.0226 | 0.0106 |
|  | Explained variation (cumulative) | 28.66 | 53.77 | 61.04 | 64.45 |
|  | Pseudocanonical correlation | 0.875 | 0.7659 | 0.7484 | 0.7086 |
| **P3** | Eigenvalues | 0.3772 | 0.3164 | 0.2136 | 0.0017 |
|  | Explained variation (cumulative) | 38.96 | 71.63 | 93.69 | 93.86 |
|  | Pseudocanonical correlation | 0.9603 | 0.9986 | 0.9828 | 0.2846 |
| **P4** | Eigenvalues | 0.1494 | 0.0726 | 0.0379 | 0.003 |
|  | Explained variation (cumulative) | 33.15 | 49.27 | 57.68 | 58.34 |
|  | Pseudocanonical correlation | 0.7944 | 0.8306 | 0.7706 | 0.2572 |