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Supplement of

Modeling the effects of tree species and incubation temperature on soil's extracellular enzyme activity in 78-year-old tree plantations

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Supplementary materials

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Table S1. *F*-test results showing the effects of tree species and temperature on soil's extracellular enzyme activity in 78-year-old forest plantations with different tree species with Model 1.

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| | BG | NAG | LAP | AP |
|------------------|-----------|-----------|----------|-----------|
| Temperature (T) | 586.39*** | 493.56*** | 84.93*** | 477.71*** |
| Tree species | 23.44** | 5.25* | 5.41* | 35.46** |
| T × tree species | 0.15 | 0.39 | 7.02 | 0.01 |

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*, ** and *** indicate significant differences at $P < 0.05$, $P < 0.01$ and $P < 0.001$, respectively.

BG, β -glucosidase; NAG, *N*-acetylglucosaminidase; LAP, leucine aminopeptidase; AP, acid phosphatase

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Table S2. Comparison of the performance of the fitting results between Model 1 and Model 2 using the Akaike information criterion and the Bayesian information criterion.

| | <u>AIC</u> | | <u>BIC</u> | |
|-----|------------|---------|------------|---------|
| | Model 1 | Model 2 | Model 1 | Model 2 |
| BG | 83.25 | 77.73 | 106.33 | 93.12 |
| NAG | 81.50 | 76.73 | 104.58 | 92.12 |
| LAP | 12.73 | 11.57 | 10.35 | 3.82 |
| AP | 80.45 | 74.47 | 103.53 | 89.86 |

15 BG, β -glucosidase; NAG, *N*-acetylglucosaminidase; LAP, leucine aminopeptidase; AP, acid phosphatase; AIC, Akaike information criterion; BIC, Bayesian information criterion

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10 **Table S3.** *F*-test results showing the effects of tree species and temperature on soil's extracellular enzyme activity with Model 2.

| | BG | NAG | LAP | AP |
|--------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Temperature | 603.35 ^{***} | 533.38 ^{***} | 134.92 ^{***} | 502.63 ^{***} |
| Tree species | 24.12 ^{**} | 6.16 [*] | 7.37 ^{**} | 37.91 ^{**} |

^{*}, ^{**} and ^{***} indicate significant differences at $P<0.05$, $P<0.01$ and $P<0.001$, respectively.

15 BG, β -glucosidase; NAG, *N*-acetylglucosaminidase; LAP, leucine aminopeptidase; AP, acid phosphatase

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Table S4. Model parameters of Equation 5 for residual soil C contents under different tree species across time with different extracellular enzyme activities.

| | BG | NAG | LAP | AP |
|---------------|-------------|-------------|-------------|-------------|
| β_0 | -2.19785309 | -2.39483244 | -0.55407280 | -0.50758993 |
| β_1 | 0.08273358 | 0.07592116 | 0.03148246 | 0.07480559 |
| β_{2sp} | -0.48260712 | 0.25997095 | -0.24294259 | -0.33588831 |
| β_{2hp} | -0.09399809 | 0.43360852 | -0.00285819 | 0.12975114 |
| β_{2kp} | 0.08828864 | 0.33102009 | 0.12017906 | 0.11112443 |
| β_3 | 0.02919402 | 0.04245054 | 0.01179556 | 0.04770020 |

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BG, β -glucosidase; NAG, *N*-acetylglucosaminidase; LAP, leucine aminopeptidase; AP, acid phosphatase

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Table S5. Model parameters of Equation 6 for residual soil N contents under different tree species across time with different extra-cellular enzyme activities.

| | NAG | LAP |
|---------------|-------------|-------------|
| β_0 | -2.39203701 | -0.56717981 |
| β_1 | 0.07592116 | 0.03148246 |
| β_{2sp} | 0.28903302 | -0.22794473 |
| β_{2hp} | 0.30922792 | -0.03046445 |
| β_{2kp} | 0.17212690 | 0.08319450 |
| β_3 | 1.27357366 | 0.36988125 |

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NAG, *N*-acetylglucosaminidase; LAP, leucine aminopeptidase

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Table S6. Half-residence time and C turnover rate of residual soil C contents under different tree species with different extra-cellular enzyme activities. The total soil C decomposition over time was calculated via Equation 5. We set the half-residence time under *Eucalyptus* for different enzyme activities as t_i ($i=1, 2, 3, 4$) and compared it with other half-residence times under coniferous tree species. The C turnover rate for each enzyme was calculated from half the residual soil C contents divided by the half -residence times under different tree species.

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| | Half-residence time | | | | C turnover rate | | | |
|-------------------|---------------------|-----------|-----------|-----------|-----------------|-------------|-------------|-------------|
| | BG | NAG | LAP | AP | BG | NAG | LAP | AP |
| Slash pine | $0.94t_1$ | $0.52t_2$ | $0.61t_3$ | $1.01t_4$ | $5.80/t_1$ | $10.48/t_2$ | $8.93/t_3$ | $5.40/t_4$ |
| Hoop pine | $0.64t_1$ | $0.44t_2$ | $0.48t_3$ | $0.63t_4$ | $8.52/t_1$ | $12.39/t_2$ | $11.35/t_3$ | $8.65/t_4$ |
| Kauri pine | $0.53t_1$ | $0.49t_2$ | $0.42t_3$ | $0.64t_4$ | $10.28/t_1$ | $11.12/t_2$ | $12.98/t_3$ | $8.52/t_4$ |
| <i>Eucalyptus</i> | t_1 | t_2 | t_3 | t_4 | $13.05/t_1$ | $13.05/t_2$ | $13.05/t_3$ | $13.05/t_4$ |

25 BG, β -glucosidase; NAG, *N*-acetylglucosaminidase; LAP, leucine aminopeptidase; AP, acid phosphatase

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Table S7. Half-residence time and N turnover rate of residual soil N contents under different tree species with different extracellular enzyme activities. The total soil N decomposition over time was calculated via Equation 6. We set the half-residence time under *Eucalyptus* for different enzyme activities as $t_i(i=1, 2)$ and compared it with other half-residence times under coniferous tree species. The N turnover rate for each enzyme was calculated from half the residual soil N contents divided by the half -residence times under different tree species.

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| | Half residence time | | N turnover rate | |
|-------------------|---------------------|-----------|-----------------|------------|
| | NAG | LAP | NAG | LAP |
| Slash pine | $0.56t_1$ | $0.72t_2$ | $0.38/t_1$ | $0.30/t_2$ |
| Hoop pine | $0.55t_1$ | $0.59t_2$ | $0.39/t_1$ | $0.36/t_2$ |
| Kauri pine | $0.63 t_1$ | $0.52t_2$ | $0.34/t_1$ | $0.41/t_2$ |
| <i>Eucalyptus</i> | t_1 | t_2 | $0.43/t_1$ | $0.43/t_2$ |

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25 NAG, *N*-acetylglucosaminidase; LAP, leucine aminopeptidase

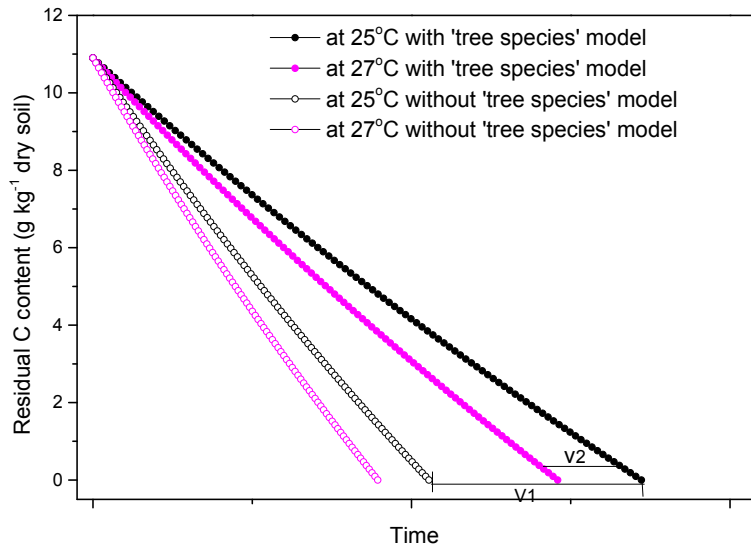
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Figure S1 A new model without considering the effect of tree species showing the changes in soil residual C contents at 25°C and at 27°C with and without the effects of tree species. V1 indicates the differences in residual C contents with and without the tree species model, and V2 indicates the differences in residual C contents at 25°C and at 27°C with the tree species model.

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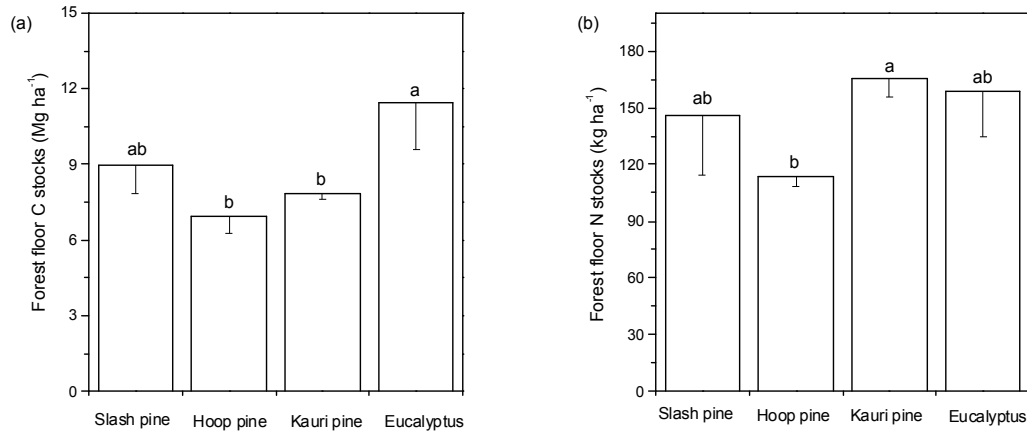


Figure S2 Differences in forest floor C (a) and N (b) stocks under different tree species. Different letters significant differences at $P < 0.05$ among the treatments.

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