

# Changes in soil chemistry and foliar metabolism of Himalayan cedar (*Cedrus deodara*) and Himalayan spruce (*Picea smithiana*) along an elevational gradient on at Kufri, HP, India

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**Supplemental Table 1.** Correlation coefficients between soil chemical variables and the first and second axes of nonmetric multidimensional scaling (NMDS) ordination scores of cedar foliar metabolites along an elevational gradient in Kufri, Himachal Pradesh, India. LOI = Loss on Ignition; measurement of Organic matter at 55°C., ECEC = Effective cation exchange capacity; the sum of concentrations of Ca, K, Mg, Na, and acidity expressed as cmolc kg<sup>-1</sup>.

| Vectors | NMDS1 | NMDS2 | r <sup>2</sup> | P     |
|---------|-------|-------|----------------|-------|
| pH      | −0.21 | −0.98 | 0.16           | 0.001 |
| LOI     | −1.00 | −0.09 | 0.29           | 0.001 |
| TN      | −0.98 | 0.18  | 0.40           | 0.001 |
| TC      | −0.99 | 0.14  | 0.23           | 0.001 |
| Ca      | −0.72 | −0.70 | 0.29           | 0.001 |
| K       | 0.03  | −1.00 | 0.13           | 0.001 |
| Mg      | −0.62 | −0.78 | 0.34           | 0.001 |
| P       | −1.00 | −0.06 | 0.37           | 0.001 |
| Al      | 0.81  | −0.59 | 0.02           | 0.333 |
| Fe      | 0.03  | 1.00  | 0.02           | 0.221 |
| Mn      | 0.15  | 0.99  | 0.04           | 0.058 |
| Na      | 0.36  | −0.93 | 0.05           | 0.041 |
| ECEC    | −0.67 | −0.74 | 0.30           | 0.001 |

**Supplemental Table 2.** Correlation coefficients between soil chemical variables and the first and second axes of nonmetric multidimensional scaling (NMDS) ordination scores of spruce foliar metabolites along an elevational gradient in Kufri, Himachal Pradesh, India. ECEC = Effective cation exchange capacity; the sum of concentrations of Ca, K, Mg, Na, and acidity expressed as cmolc kg<sup>-1</sup>.

| Vectors | NMDS1 | NMDS2 | r <sup>2</sup> | P     |
|---------|-------|-------|----------------|-------|
| pH      | −0.52 | −0.86 | 0.04           | 0.183 |
| LOI     | −0.52 | −0.86 | 0.17           | 0.002 |
| TN      | −0.52 | −0.86 | 0.24           | 0.001 |
| TC      | −0.52 | −0.86 | 0.12           | 0.011 |
| Ca      | −0.52 | −0.86 | 0.03           | 0.285 |
| K       | 0.52  | 0.86  | 0.08           | 0.050 |
| Mg      | −0.52 | −0.86 | 0.01           | 0.775 |
| P       | −0.52 | −0.86 | 0.32           | 0.001 |

|             |       |       |      |       |
|-------------|-------|-------|------|-------|
| <b>Al</b>   | 0.52  | 0.86  | 0.07 | 0.080 |
| <b>Fe</b>   | -0.52 | -0.86 | 0.00 | 0.850 |
| <b>Mn</b>   | -0.52 | -0.86 | 0.09 | 0.026 |
| <b>Na</b>   | 0.52  | 0.86  | 0.05 | 0.162 |
| <b>ECEC</b> | -0.52 | -0.86 | 0.02 | 0.431 |

**Supplemental Table 3.** Results from PERMANOVA (adonis) test of foliar metabolites in cedar growing along an elevational gradient in Kufri, Himachal Pradesh, India. The analysis was performed on a Bray-Curtis dissimilarity matrix of foliar metabolites with 999 permutations.

|           | <b>df</b> | <b>Sums of Squares</b> | <b>Mean Squares</b> | <b>F Model</b> | <b><math>r^2</math></b> | <b>P</b> |
|-----------|-----------|------------------------|---------------------|----------------|-------------------------|----------|
| Elevation | 3         | 0.39                   | 0.13                | 53.02          | 0.55                    | 0.001    |
| Residuals | 132       | 0.32                   | 0.00                | 0.45           |                         |          |
| Total     | 135       | 0.71                   | 1.00                |                |                         |          |

**Supplemental Table 4.** Results from PERMANOVA (adonis) test of spruce foliar metabolites along an elevational gradient in Kufri, Himachal Pradesh, India. The analysis was performed on a Bray-Curtis dissimilarity matrix of foliar metabolites with 999 permutations.

|           | <b>df</b> | <b>Sums of Squares</b> | <b>Mean Squares</b> | <b>F Model</b> | <b><math>r^2</math></b> | <b>P</b> |
|-----------|-----------|------------------------|---------------------|----------------|-------------------------|----------|
| Elevation | 1         | 0.05                   | 0.05                | 18.22          | 0.20                    | 0.00     |
| Residuals | 74        | 0.22                   | 0.00                | 0.80           |                         |          |
| Total     | 75        | 0.27                   | 1                   |                |                         |          |